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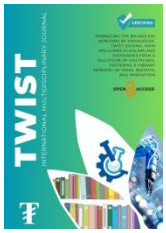

Exploring Antimicrobial Potentials of Herbal Skin Cream for Nourishment and Protection

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Abstract

*Background***:** Creams are well renowned for their ability to hydrate, nourish, and provide other skin benefits without the use of artificial chemicals. These creams offer a gentle yet effective skincare solution, seeking a more natural and holistic approach to skin care.

Objective: The primary goal of this study was to formulate and evaluate the herbal cream for skin protection, hydration, and nourishment with antifungal, antibacterial, and anti-acne properties, also to address various skin conditions

*Methods***:** The cream was prepared by using the slab technique/extemporaneous method for geometric and homogenous mixing of all the excipients and the herbal extracts. By using slab technique, we have developed four different herbal cream formulations, namely F1, F2, F3 and F4. All these formulations were evaluated for different parameters like appearance, PH, Spreadbility, stability etc and simultaneously examined for *in-vitro* anti-microbial activity.

*Results***:** The results reveal that, among all four formulations, F1 and F2 formulations showed good appearance, Grittiness and Homogeneity, good Spreadbility, no phase separation. whereas other two formulations F3 and F4 showed no skin irritation, redness and erythema during irritancy study and they were washable easily. Overall, all the four formulations were found to stable at room temperature and F1 and F2 formulations showed significant antimicrobial activity compared to standard.

Conclusion: It has been proven that, Herbal skin nourishing cream F1 and F2 formulations were found most suitable in terms of stability, appearance, excellent hydration to the skin and other properties and showed better antimicrobial activity.

Keywords

Aloe vera, Orange peel, Beetroot extract**,** Cucumber peel, Anti-microbial, Skin protection, Skin nourishment

INTRODUCTION

Beauty and skin health are essential components of overall wellbeing, and there is an increasing global need for high-quality skincare products. The capability of skin nourishing creams to improve the texture, moisture, and general appearance of the skin has led to tremendous growth in demand for these products (Riya Arora *et al.*, 2019). Creams are semi-solid emulsions which contain mixtures of oil and water. Their consistency varies between liquids and solids. Creams are topical formulation usually for application to the skin. Skin nourishing cream: Skin-nourishing creams, commonly referred to as moisturizers or emollients, are topical formulations designed to maintain and promote the health of the skin. These types of moisturizers are essential for keeping skin hydrated, preventing dryness, and shielding it from external aggressors. An effective skin-nourishing cream can offer several advantages, including increased skin suppleness, diminished wrinkles, and a radiant complexion (Kajal Nivritti *et al.*, 2022).

Askin-nourishing cream's performance is significantly influenced by the components it contains. Shea butter, Cocoa butter, and other oils are a few of the elements that soften the skin and keep moisture in. Popular humectants like glycerine and hyaluronic acid pull moisture from the air into the skin to hydrate it. Green tea extract and the vitamins C and E provide resistance against free radicals and environmental harm. Amino acid components encourage the synthesis of collagen, which enhances skin firmness and suppleness (Mohiuddin, 2019).

Different herbal active components are used in the formulation of herbal skin cosmetics, which are then mixed with the cosmetic foundation to hydrate and treat various skin conditions. Compared to synthetic cream, herbal creams have various advantages. Most creams now on the market are made from medications with a synthetic origin and provide more fairness to the face, but they also have several undesirable side effects, including irritation and allergic reactions. Whereas Herbal creams provide nourishment and many other benefits to the skin without showing any adverse effects (Ashwant *et al.*, 2009).

Various herbs were found to have potentially healing and protective properties for the skin. Aloe vera, orange peel powder, beetroot extract, cucumber peel juice are used in the formulation of herbal skin cosmetics, which are then mixed with the cosmetic foundation to hydrate and treat various skin conditions.

Therefore, an attempt is made to prepare an herbal skin nourishing cream using these natural ingredients may be useful for preparation, formulation and evaluation of skin nourishing cream (Alka *et al.*, 2014)

Aloe vera Gel

The most important constituents of Aloe vera are the three isomers of Aloin and they are Barbaloin, β- barboloin and Isobarbaloin. Other constituents are Amorphous Aloin, resin, emodin and Aloe-emodin. Barbaloin is present in all the varieties; it is slightly yellow coloured, bitter, water soluble, crystalline glycoside. It has been used as a resource of functional food such as yogurt or for the preparation of health drinks, including tea. Majorly used to trat Healing of wounds, acts as anti- inflammatory, anti-oxidant, immunomodulatory, antifungal, antiviral and antimicrobial effects (Kamble Anuja Kalyan *et al.*, 2023).

Fig. 1 Aloe vera gel

Orange peel powder

The major constituents such as citral, Limonene, hesperidin, pectin and Vitamin C. Other minor constituents like Monoterpene, Aurantimarin, Aurantimaric acid, Decanal, Octanol etc. Mainly used to prevent the skin free radical damaging, oxidative stress, skin hydration, lighten the skin, anti-aging, anti-wrinkle etc. It removes dirt from the skin, sweat and contaminations, helps in skin tone and complexation (Vaishnavi Jagdish Gupta *et al.*,2024).

Fig. 2 Orange peel Powder

Beetroot extract

Reported the several phytoconstituents includes, betalanin, polyphenols, flavonoids, inorganic nitrate and saponins and lower concentration like magnesium, inorganic nitrate, saponins, zinc, copper, calcium etc. It gives glossy appearance to skin, prevents damaging and keeps the skin moisture (Priya Patel *et al*., 2022).

Fig. 3 Beetroot Powder

Cucumber Peel: The pytoconstituents like Carbohydrate, Fats , vitamins, minerals, other enzymes.

Due to presence of rich water content, it keeps the skin soft and tightly highly hydrating,

Hydration, contains silica and mineral helps in skin tighten and firm when topically applied, it also improves the texture, cooling effect and refresh tired or overheated. Sometimes used as eye mask, as natural cleaners which helps in removing the dirt, as sunburns, skin rashes and other skin disorders (Swati *et al.*, 2024).

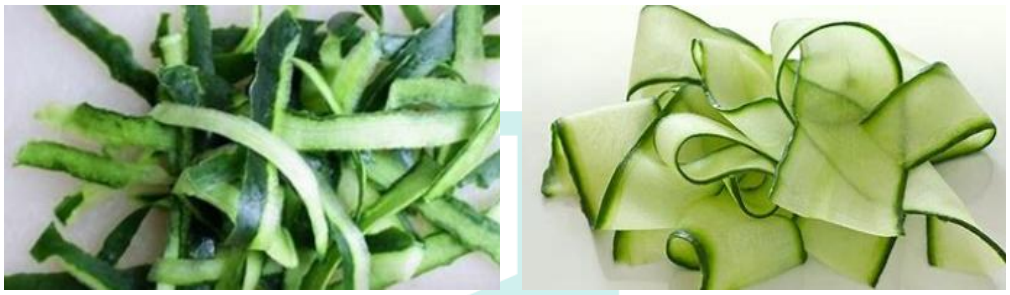

Fig. 4 Cucumber peel

A skin cream's purpose is to protect the skin from various environmental factors and weather conditions while also providing calming effects. There are various kinds of creams, including massage, night, vanishing, cleansing, cold, and hand and body creams. Our primary goal is to create a herbal cream that has multiple uses, like moisturizer, reduce acne and skin irritation, reduce skin diseases like eczema, psoriasis, dry skin, wrinkles, rashes etc and also adding glow to the face. We have used four herbal ingredients in our preparation which are aloe vera, orange peel powder, beet root extract and cucumber peel extract used to reduce scar, pigmentation, redness and itching of the skin. Cucumber peel extract acts as anti- ageing, anti-wrinkles and protect against UV radiation and environmental hazards and other skin allergic actions (Aakanksha Bharat Pawa1*et al*., 2023). Due to its cooling qualities, cucumber has a tendency to calm and refresh you in this pricking heat (Aniket Dilip Surya *et al.*, 2023).

MATERIAL AND METHODS

Collection of Herbs

The Aloe vera plant, orange peel, beetroot and cucumber were collected from local areas, Bengaluru. Karnataka.

Preparation of different herbal extracts

Preparation of Aloe vera extract

Collect the matured and healthy leaves of aloe vera, washed with distilled water, then outer part of leaf was peeled off by using a sterile knife. Then the aloe Vera gel of parenchymatous tissue was removed using the sterile knife which is colourless. Then it is filtered using muslin cloth to remove the fibers and impurities, the clear aloe vera gel was used in the preparation (Vallabh Chandegara, *et al.*, 2014).

Preparation of orange peel extract

Nearly about the 2 kg of orange fruits was purchased from local market, Bengaluru, the fruits were peeled off and dried in shade dry from 5-6 days, then powered and soaked in distilled was with occasional shaking. The obtained extract was lyophilized further until to get dry orange peel powder extract and finally stored in desiccator. The yield was found to be 7.3g.

Preparation of Beet root extract

About 1 kg of Beetroot was purchased from local market, washed and chopped in to small piece blend with mixer to get beetroot extract, fresh juice was lyophilized further until to get dry beetroot extract powder and finally stored in desiccator. The yield was found to be 9.2 g

Preparation of Fresh Cucumber peel extract

Extracts were prepared by the maceration method- Fresh mature cucumbers were purchased from the local market. The cucumbers were washed thoroughly under running tap water and were manually peeled using a sterilized peeler. The peels were crushed peeled extracted fresh juice was used in the preparation.

Method of preparation of polyherbal cream

a) Add the known quantity of borax in described amount of water, kept on water bath to get solution (Prashant C *et al.,* 2020).
b) The above prepared solution, add accurate amount of freshly prepared aloe vera gel for F1, orange peel extract powder in F2, beetroot extract powder in F3 and finally freshly prepared cucumber peel juice in F4 formulations were added accordingly. (solution1)
c) Add rose oil to China dish containing beeswax and melt to get uniform liquid and poured in to F1 formulation (solution 2).
d) Similarly, prepare and add the beeswax with rose oil solutions for other three (F2, F3, and F4 formulations (solution 2).
e) Then four the solution 1 into the China dish containing solution 2 dropwise with continuous stirring until to get uniform phase for all the formulations (F1, F2, F3 and F4) and finally add methyl paraben as preservative for all the formulations.

Table 1 Different compositions of herbal skin nourishing cream

Sl. No	Ingredients	F1	F2	F3	F4
1	Aloe vera extract-	3 ml	2.5ml	2 ml	1.5ml
2	Orange peel extract	1ml	1ml	0.5ml	0.5ml
3	Beet root extract	0.5ml	0.5ml	0.25ml	0.25ml
4	Cucumber peel Juice	3 ml	2.5ml	2 ml	1.5ml
5	Beeswax	3 g	3.5g	4.0g	4.5 g
6	Borax	0.5g	0.5g	0.5g	0.5g
7	Methyl paraben	0.02g	0.02g	0.02g	0.02g
8	Propyl paraben	0.02 g	0.02 g	0.02 g	0.02 g
9	Peppermint Oil	2ml	2ml	2ml	2ml
10	Distilled water	Q.S	Q.S	Q.S	Q.S

Table 2 Role of individual ingredients

Sl. No	Ingredients	Impact
1	Aloe vera	Moisturizer, ant-ageing, anti-oxidant, reduces acne,
2	Orange peel	Anti-wrinkle, anti-ageing
3	Beet root	Glossy appearance, prevent skin damgaeing
4	Cucumber peel	Anti-oxidant, as skin tonner, astringent, colling effect
5	Beeswax	Stabiliser, emulsifying agent
6	Borax	Emulsifying agent to soap, as alkaline agent
7	Methyl paraben	Preservative
8	Propyl paraben	Preservative
9	Peppermint Oil	Fragrance or flavouring agent
10	Distilled water	As vehicle

Evaluation of herbal skin nourishing cream

1. **Physical evaluations:** all the four formulated herbal cream was further evaluated by using the following physical parameters: Colour, Odour, Consistency, and State of the formulations (Ruhil *et al.,* 2018)**.**

a) Colour: The colour of the cream was observed by visual examination.
b) Odour: The odour of cream was found to be characteristics.
c) Consistency: The formulation was examined by rubbing cream on hand manually. The cream having smooth consistency. Cream did not leave greasy substances on skin surface after application.
d) State: The state of cream was examined visually. The cream having a semisolid state.

2 Grittiness and Homogeneity

The presence of any particulate matter in details was observed minutes and recorded and at the same time all formulations were tested for the homogeneity by visual appearance and by touch and results were recorded in the same **table 3** (Gupta N *et al* 2021).

3 Spread ability

a. 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 the better.

b. Then, 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. Both slides were pressed in order to gen the uniform film thickness by placing. They were pressed together to obtain a film of uniform thickness by placing 1000 g weight for 5 minutes, and thereafter, add extra weight of 10 g to the pan, and the top plate was subjected to pull with the help of string attached to the hook. The time in which the upper glass slide moves over the lower plate to cover a distance of 10 cm was noted. The Spread ability (S) can be determined using the formula;

$$S = (M\ X\ L)/T$$

where

S- Spread ability
m-weight binds to the upper glass slide
L-Length budged on a glass slide
T-Time required to upper slides to separate (Manisha Yogesh Sonalkar *et al*., 2016).

4. PH and Phase and **Phase separations**

All the prepared formulations were tested PH by using digital pH meter. The solution of cream was prepared by using 100 ml of Distilled water and set aside 2h. PH was determined in three times for solution and the average value was calculated.[16]. The different formulations were 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 (Dhase *et al*., 2014 and Chen *et al.*, 2016).

5. Irritancy

Mark the area (1 cm^2) 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, erythema, and edema if any for an interval up to 24 h and reported (Uddandu Saheb *et al*., 2018).

6. Stability studies

The stability studies for the four formulations were accessed using ICH Guidelines. To evaluate the formulations' stability under extremely low temperatures, 15 grams of cream from each of the formulation was prepared 48 hours in advance, subjected to -8°C for 48 hours, and subsequently stored at 25°C for six intervals. The assessment of the gel formulation's stability was then conducted till 60 days (Supriya Bhosale *et al.*, 2024 and Saurabh Dilip Bhandare *et al.*, 2024).

7. Anti-bacterial activity of Herbal cream:

For this, the Agar well diffusion method was employed. Strains of *Staphylococcus aureus* and *Escherichia coli* were employed in the investigation. To ensure that the bacterial cultures were evenly distributed throughout the medium, they were added to the recently created nutritional media and thoroughly mixed. Sterilized petri dishes were filled with the medium, which was then left to stand still and harden. Next, wells measuring 6 mm in diameter were created in the petri dishes using sterilized cork borer, to which the produced gel formulations were poured, enabling the medication to diffuse throughout the medium (Valgas *et al*., 2007). After that, it was incubated at 370 °C for a full day. After that, it was incubated at 370° C for a full day. With the aid of a ruler, the diameter of the zone of inhibitions was measured (in mm). The antibacterial activity of each formulation was evaluated in triplicate, and the average result was noted. Here, the study's reference medication for comparison was standard Clindamycin gel.

RESULT AND DISCUSSION

Physical evaluation for four different herbal skin nourishing cream

The physical evaluation of herbal cream formulation's colour, odour, texture and state in all the four formulations like F1, F2, F3, displayed in the **table 3.** The colour was found to be different in all formulations like F1 was found to be greenish colour, F2 was in pale greenish, F3 was Pale pink in colour and F4 was in Pale greenish.

Table 3 Physical Parameters for all four formulations

Parameters	F1	F2	F3	F4
Colour	Greenish	pale greenish	Pale pink	Pale greenish
Odour	Pleasant	Pleasant	Pleasant	Pleasant
Texture	Smooth	Smooth	Smooth	Smooth
State	Semi- solid	Semi- solid	Semi- solid	Semi- solid

Grittiness and Homogeneity

The cream consistency appears to be three categories i.e., good, excellent and average which was recorded manually**.**

Table 4 Grittiness and Homogeneity for all four formulations

Parameters	F1	F2	F3	F4
Grittiness	No grittiness	No grittiness	No grittiness	No grittiness
Homogeneity	Good	excellent	good	Average

Spread ability

Table 5 shows the Spreadbility of the herbal cream formulations. Formulation F1 and F2 exhibits superiority in comparison to formulations F3 and F4 were displayed in table 5.

Table 5 Spreadbility of four different Herbal cream

Formulations	Weight tied	Length of slide (cm)	Time taken (sec)	Spreadbility (g x cm/sec)
F1	10	7.5	6.2	22.1
F2	10	7.5	6.0	23.6
F3	10	7.5	7.7	20.1
F4	10	7.5	6.9	21.8

PH and Phase and **Phase separations**

The pH levels were measured by using pH meter, given in the **table 6,** which shows each cream formulations pH. Formulations F1and F2 demonstrate superiority when compared to F2 and F3.

Table 6 pH and Phase separation observation table

Formulation	pH	Phase separation
F1	6.7	NO
F2	6.9	NO
F3	6.5	NO
F4	6.3	NO

Irritancy

The results of all four formulations F1, F2, F3 and F4 showed no sign of skin irritation erythema and edema which were recorded**.**

Table 7 Irritancy study observations

Formulations	Irritant effect	Erythema	Edema
F1	Nil	Nil	Nil
F2	Nil	Nil	Nil
F3	Nil	Nil	Nil
F4	Nil	Nil	Nil

Stability testing

All four formulations demonstrate stability in both thermal and freeze tests which were recorded in below table.

Table 8 Physical stability studies for formulated Herbal nourishing cream

Duration	Storage Condition	Appearance	Colour			
			F1	F2	F3	F4
10 day	8 °C	Semi-solid glossy	Greenish	Pale yellowish	Pinkish	Pale greenish
	40 °C	Semi-solid glossy	Greenish	Pale yellowish	Pinkish	Pale greenish
30 day	8 °C	Semi-solid glossy	Greenish	Pale yellowish	Pinkish	Pale greenish
	40 °C	Semi-solid glossy	Greenish	Pale yellowish	Pinkish	Pale greenish
60 day	8 °C	Semi-solid glossy	Greenish	Pale yellowish	Pinkish	Pale greenish
	40 °C	Semi-solid glossy	Greenish	Pale yellowish	Pinkish	Pale greenish

Anti-bacterial activity of Herbal cream

Formulated poly herbal cream was evaluated for its antibacterial activity and results are given in table 8 and figure 5. In this, study of Anti-bacterial activity of formulated herbal nourishing skin cream was done by agar plate method by employing *Staphylococcus aureus* and *Escherichia coli* as test organism. Microbial evaluation was measured in terms of formation of zone of inhibitions and Clindamycin was taken as the standard drug. All the different formulations F1 and F2 showed 25.55±0.25, 29.01±0.71 zone of inhibition for *S. aureus* and for *E. coli* was found to be 24.09 ± 0.15, 27.67 ±0.13, while standard drug Clindamycin gel showed 30.33±0.25, 28.05±0.55 zone of inhibition against *S. aureus* and *E. colli*, whereas F3 and F4 formulations exhibited moderated activity compare to standard shown in Table 8.

CONCLUSION

The prepared skin nourishing herbal cream has best properties and having nutritional values using safe chemicals and no side effects which protect the skin from the various skin problems. Since the cream was prepared by using simple ingredients and simple methods. Herbal cosmetic formulation is more efficacy and safety to apply topically and protect the skin. By using Aloe vera gel, orange peel powder, beetroot powder and Cucumber peel juice of prepared herbal cream

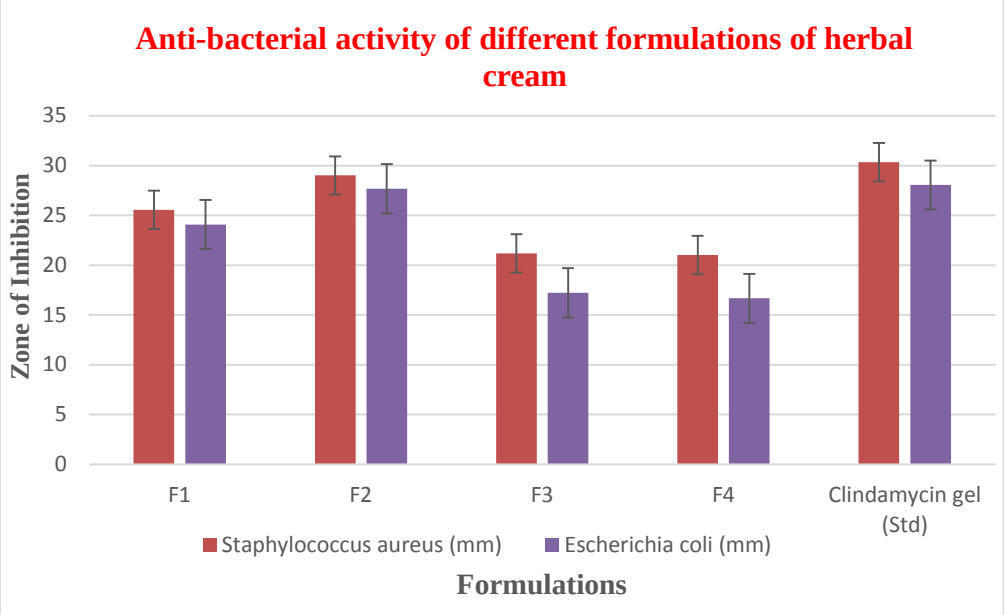

Fig 5 Anti-microbial activity of different formulations of Herbal cream

showed the multipurpose effect on skin and all herbal ingredients were used showed different significant activities. Based on the results we can formulate these three formulations F1, F2, F3 and F4 were stable at room temperature and can be safely used on the skin.

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DECLARATIONS OF CONFLICT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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