Original Research Paper

Volume - 14 | Issue - 06 | June - 2024 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Pharmaceutical Science

FORMULATION AND EVALUATION OF SUN PROTECTION EFFICACY OF HERBAL CREAM CONTAINING LIQUORICE

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ABSTRACT The primary aim of the study is to develop cream containing herbal extract and assess their effectiveness. The utilization of natural products is of great significance due to concerns regarding the toxicity and side effects associated with modern drugs. The objective of this study is to formulate sun protection creams that are cost-effective, non-toxic, and efficacious. *Glycyrrhiza glabra* is renowned for its abundance of natural antioxidants and various phytoconstituents, which are known to possess properties that can shield the skin from the damaging effects of ultraviolet rays. By incorporating these potent botanical ingredients into the cream, aim to exploit their protective qualities to create a product that not only safeguards the skin but also promotes its overall health and well-being. The Prepared formulation showed good spreadability, and good consistency and viscosity. Stability parameters like visual appearance, nature, viscosity, spreadability and fragrance of the formulations showed that there was no significant variation during the study period. The study on skin moisturization showed very significant results ($p<0.001$), while the test on skin occlusion revealed that the formulation had a notable percentage of occlusion ($p<0.01$). The sun protection factor analysis indicated that the formulation provided significant sun protection ($p<0.01$), comparable to the marketed cream.

KEYWORDS : Herbal cream, Skin protection, SPF, Skin moisturizing, Liquorice.

INTRODUCTION

Herbal cosmetics are formulations containing phytochemicals sourced from different botanical origins, affecting skin functions and providing essential nutrients for healthy skin or hair. When natural herbs and their derivatives are used for their aromatic properties in cosmetic products, they are termed as herbal cosmetics. [1,2] Organisms living in tropical and subtropical regions are exposed to higher levels of damaging UVR compared to other geographical locations. To adapt to these conditions, organisms must develop photo-protective mechanisms to counteract the generation of free radicals. The herbal cream is those when natural herbs and their products used for their pharmaceutically value in product preparation among consumers for herbal products triggered the demand for natural products and natural extracts in cosmetics preparations. Ayurveda is one of the oldest traditional systems of medicine that uses plants and their extracts of different part for treatment and management of various disease and infections. Sunscreen preparation is applied topically, and its purpose is to heal, prevent or resist skin from painful or harmful effects of sunburn, suntan, sun cancer, and premature skin aging and to escalate the level of Sun Protection Factor (SPF). Its ability to absorb, reflect or scatter some of the sun's UV radiation on the skin from extra vagant exposure to ultraviolet radiation Skin melanoma, sunburn, photoaging, skin pigmentation, and various painful or precarious effects are caused by UVA and UVB rays. [3,4] The demand for natural active ingredients as sun protectants not only creates a promising market for consumers who believe in their benefits but also hints at the future of natural sunscreens. Glycyrrhiza glabra is renowned for its abundance of natural antioxidants and various phytoconstituents, which are known to possess properties that can shield the skin from the damaging effects of ultraviolet rays [5]. By incorporating these potent botanical ingredients into the cream, we aim to exploit their protective qualities to create a product that not only safeguards the skin but also promotes its overall health and well-being [6].

MATERIALS AND METHODS

Preparation of Ethanolic Extract

The measured and powdered *Glycyrrhiza glabra* were extracted by cold maceration using 70% ethanol at temperatures between 15-25°C for 48-96 hours. Afterward, the solution was filtered through Whatman filter paper no. 1, and the filtrate was concentrated under vacuum to obtain residues. These concentrated extracts were then stored in desiccators for future use [7].

Formulation of Herbal Extract Creams

To prepare the cream, we dissolved all water-soluble ingredients in water and combined the oil-soluble ingredients in a separate container at a temperature of 75°C ± 5°C. The water phase was then gradually added to the oil phase with continuous stirring, and the mixture was homogenized for 30 minutes [8].

Spreadability[11]

The appropriate amount of herbal sunscreen was applied between two slides, and under specified load directions, and the two sides took the time in seconds to slide off. Spreadability was defined as the amount of time it took to separate two slides [9]. The formula for calculating it is:

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

Where, M = weight tied to upper slide
L = length of glass slide
T = time taken to separate the slides

Measurement of Viscosity

The viscosity of the cream was measured using a Brookfield viscometer. Using a Brookfield DV-II+ viscometer equipped with an LV-4 spindle, the cream was poured into the viscometer's adaptor. The rotational speed was gradually increased from 0.5 to 20 rpm [10].

Skin Moisturizing Effect Study

Photodamaged skin can become pale, thin, and dry, making moisture replenishment a crucial function of cosmetics. Skin hydration levels were assessed using a corneometer attached to a multiprobe adapter. This device measures capacitance changes, which correlate with the water content in the skin's outermost layer, the stratum corneum [11].

In Vitro Occlusion Studies

The occlusivity of the formulations was evaluated using the occlusion factor. In this in vitro model, a beaker containing water is covered with filter paper, and 200 mg of the formulation is evenly spread over an 18.8 cm^2 area on the paper. A reference control is established with filter paper in another beaker without any formulation. An occlusion factor of zero indicates no occlusion effect compared to the reference, while a factor of 100 indicates complete occlusion. The occlusion factor is calculated using the formula [12]:

$F=100(A-BA)$, $F=100(AA-B)$ where AA represents water loss without the sample (reference), and BB represents water loss with the sample.

In Vitro Sun Protection Factor Determination by UV Spectrophotometer:

The efficacy of a sunscreen cream is determined by its Sun Protection Factor (SPF). In the in vitro method, the reduction of UV irradiation is measured by evaluating the transmittance after passing through a layer of the product. A common approach involves measuring the spectral transmittance across UV wavelengths from 280 to 400 nm. The absorbance values observed at intervals of 5 nm are computed using a specific formula [13,14]:

$$SPF = CF \times \sum_{290}^{230} (EE(\lambda) \times Abs(\lambda))$$

Where:

CF represents the correction factor (10),

EE(λ) represents the erythrogenic effect of radiation at wavelength λ,

Abs(λ) represents the spectrophotometric absorbance values at wavelength λ.

The values of EE(λ)×I are constant and determined by Sayre et al. The prepared aliquots are scanned between 290 and 320 nm, and the obtained absorbance values are multiplied by the respective EE(λ)×I(λ) values. The summation of these values is then multiplied by the correction factor (10).

Stability Of Herbal Cream Formulation Through Three-cycle Temperature Testing:

The chosen formulation underwent three to four freeze-thaw cycles, involving freezing at -10°C for 24 hours followed by thawing at 30°C for an additional 24 hours [15]. Following the study period, the formulations were assessed for any changes in pH, color, consistency, fragrance, and viscosity.

RESULTS AND DISCUSSION

The Physiochemical evaluation of the formulated cream demonstrated favourable characteristics such as good consistency, yellowish colour, and pleasant fragrance, which are desirable attributes for a cosmetic product. Additionally, the pH level of 5.6 falls within the range suitable for maintaining skin health and compatibility.

The spreadability study indicated that the formulated cream exhibited satisfactory spreadability, which is crucial for ensuring uniform application and coverage on the skin and results are given in table 1. Furthermore, the viscosity measurements revealed a consistent viscosity profile across different rotational speeds, indicating stable rheological properties and the results are given in table 2.

Table 1. Spreadability Study

S.I. No.	Formulation	Spreadability
1	F	18.833±1.560

Values are mean ± SEM, n=6

Table 2. Viscosity

RPM	Viscosity (cps)
20	652±10
10	975±15
5	1721±12
1	3342±10
0.5	6935±20

Values are mean ± SEM, n=6

In vitro occlusion testing demonstrated that the formulated cream effectively reduced water loss and exhibited a significant occlusion factor compared to both the control and the marketed cream. This suggests that the formulation has the potential to form a protective barrier on the skin, thereby preventing dehydration and maintaining skin hydration levels and results are given in table 3.

Table 3. In Vitro Occlusion

Formulations	Water loss (ml)	% Occlusion factor (F)
Control	0.8 ± 0.030	--
Formulation	0.37±0.029**	53.75
Marketed Cream	0.34±0.051**	57.50

Values are mean ± SEM, n=6, ** t-test significant (P<0.01)

The SPF study revealed a significant sun protection factor (SPF) for the formulated cream compared to both the blank and the marketed cream. This indicates that the formulated cream has considerable sun protection efficacy, which is a key attribute for a sun protection product and the results are given in table 4.

Table 4. SPF Study

Formulations	SPF
Blank	1.66 ± 0.037
Formulation	9.11±0.057**
Marketed Cream	12.12±0.051

Values are mean ± SEM, n=6, ** t-test significant (P<0.01)

The stability of the herbal cream is characterised by maintenance of physical parameters. In the three cycles temperature testing of the formulation showed good stability and maintained the physical properties as that of the unexposed formulation. The formulated sun protection herbal cream utilizing *Glycyrrhiza glabra* extract as a key ingredient demonstrated promising results in terms of phytochemical composition, physiochemical properties, spreadability, occlusive efficacy, and sun protection factor.

CONCLUSION

This study supports the traditional use of herbal extracts in cosmetic products with sun protection activity. The presence of constituents responsible for antioxidant activity imparts wound healing, antifungal, premature aging, moisturizer and anti-inflammatory effect to the skin when it is applied. The formulation was prepared with *Glycyrrhiza glabra*. The Prepared formulation showed good spreadability, and good consistency and viscosity. The formulation showed proper pH range; it confirms the compatibility of the formulations with skin secretions. The In-Vitro Sun Protection Factor Determination study confirms that the formulation has considerable sun protection activity. The Stability Study by Freeze Thaw Testing confirms that the selected formulation is stable at accelerated temperature condition. From the present study it can be concluded that it is possible to develop cream containing herbal extract having sun protection activity which has skin whitening, moisturizing and anti-ageing.

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