Formulation and evaluation of polyherbal cosmetic cream

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Abstract

Purpose: Ayurveda is one of the oldest, most renowned and worldwide accepted traditional system of medicine. There is global attraction towards production and use of eco-friendly cosmetic products prepared using potent herbs mentioned in ancient Indian system of medicine, Ayurveda. The present study aims at formulation of polyherbal cosmetic cream for the use of moisturising, nourishing and cure of numerous skin disorders.

Method: The methodology involves selection of promising herbs stated for healthy skin in Ayurveda and reported as antioxidant in modern science; preliminary phytochemical screening of alcoholic extracts of *Haridra*, *Tulasi* and *Triphala*; formulation of cream with herbal extracts, Alovera juice, Mentha piperita oil and minimum quantity of chemicals; evaluation of formulations for various physical parameters followed by antibacterial and antifungal activities.

Results & Conclusion: The results indicates that formulated cream is stable, effective and therefore, can be tested further for its performance.

Keywords: Ayurveda, Eco-friendly, Cosmetics, Antioxidant

Introduction:

The largest organ of the body is skin and it forms an ultimate shielding barricade against environmental stress enhancers such as transmittable pathogens, ultra-violet radiations, dust and chemical agents which causes ageing and other infections. The condition of general inner health and aging can be judged by skin[(1)]. Excessive exposure to UV radiations causes Erythema, edema, suntan, hyperplasia, early aging, and skin cancer[(2)] and is also responsible for generation of free radicals[(3, 4)]. Increasing rate of problems related to intrinsic or natural skin ageing and extrinsic skin ageing caused due to exposure to environmental factors, side effects and high cost of chemical based skin care products motivated scientific community to identify effective, eco-friendly, safe and cheaper sources for preparation of skin care products. Skin care properties of several plants have been mentioned in Ayurveda and plants are being used since ancient time for this purpose. Nowadays there is great demand of cosmetic products prepared using herbs, herbal extracts or phyto-compounds as these products not only provide beauty and better appealing appearance but also provides medicinal benefits such as immune enhancement, nutrient enrichment, antibacterial, antifungal, anticarcinogenic, and anti-inflammatory biological actions. Demand of plant derived compounds such as curcumin, catechins, ascorbic acids, gallic acids, cinnamic acids, quercetin, alpha and beta carotene, epicatechins, luteolin, fatty acids and complex polysaccharides etc. for preparation of cosmeceuticals is increasing day by day due to their multidimensional cosmetic and medicinal properties[(5-10)]. Considering all these facts, the medicinal plants for the study were selected based on literature review. The current research has been planned to carry out preliminary phytochemical screening of alcoholic extracts of Haridra, Tulasi and Triphala; formulation of cream with herbal extracts, Alovera juice, Mentha piperita oil and minimum quantity of chemicals; evaluation of formulations for various physical parameters followed by antibacterial and antifungal activities.

Materials And Methods:

The plant materials were procured from Shri Shail Herbs Pvt. Ltd., a reputed traders at Nagpur and authenticated by Principal Scientific Officer (Botanist), Mahatma Gandhi Institute for Rural Industrialization (MGIRI), Wardha. Alovera leaves were collected from the garden of MGIRI. Mentha piperita oil and all the chemicals of Merk co. were procured from Maharashtra Scientific Co., Wardha. Marketed formulations used were Himalaya kesar, alfalfa face cream and Patanjali neem, tulsi facewash.

Preparation of ethanolic extracts and preliminary phytochemical screening:

The rhizome of curcuma longa, leaves of Ocimum sanctum Linn, fruits of Phyllanthus emblica Linn, Terminalia bellirica (Gaertn) Roxb, Terminalia chebula (Gaertn) Retz, were cleaned properly with water, dried and powdered using an electric mixer, sieved and stored in an air tight container for further use. All the powdered herbal drugs (5g each) were soaked in ethanol separately for 24 hours with constant shaking for first 8 hours, filtered, extracts were subjected to preliminary phytochemical screening using standard methods [(11,12,13)].

Formulation of polyherbal cosmetic cream:

Preparation of Oil Phase: Oil phase was initialized by adding Stearic acid (17 g) in heat resistant glass beaker of capacity 250 ml and placed on hot water bath for heating, after complete dissolution of stearic acid, 0.5 g of potassium hydroxide was added and dissolved with continuous stirring, 0.5 g of Sodium carbonate was added and stirred continuously to avoid lumps. This process was carried out by maintaining the temperature at 75^{0}C.

Preparation of Aqueous Phase: The aqueous phase was initialized by adding 10 ml ethanolic extract (4ml Triphala, 3ml Turmeric and 3ml Tulsi extract) in 6g of glycerine into another glass beaker and placed it on hot water bath. Aloe Vera juice (66 ml) was added in a mixture with constant stirring followed by addition of Triethanolamine (1.2 g). This process was also carried out by maintaining the temperature at 75^{0}C.

Addition of Aqueous Phase to Oil Phase: The aqueous phase was poured in oil phase slowly by continuous stirring at 75^{0}C. Methyl paraben and Propyl paraben (2g each) were added into the mixture. The mixture was allowed to cool to room temperature by continuous stirring. Mentha piperita oil (1g) was added after complete cooling, then transferred the cream in a container sterilized with 99.5% ethanol. Then the cream was evaluated for various physical parameters.

Evaluation of cream for physical parameters:

Assessment of cream was done for various physical parameters as per official guidelines.

Appearance: The appearance of the Cream was found by observing its color, odour and texture etc.

pH: The pH of cream was determined with the help of Auto digital pH meter at 28?C by preparing 10% solution of cream, the pH meter was calibrated and measured pH was found to be 7.5.

Determination of Homogeneity: The prepared formulation was tested for the homogeneity by visual appearance and by touch.

Spreadability test: 500mg of the cream was sandwiched in between two glass slides. Weight of 100gm was placed on upper slide of glass slide. The weight was removed and extra cream was scrapped off. The lower slide was fixed on board of apparatus and upper slide was fixed with non-flexible string on which 20g load was applied. The time taken by upper slide to slip off was noted.

$S = m \times l/t$

Where, S- spread ability

m- Weight tied to upper glass slide.

l- Length moved on a glass slide.

t- Time taken.

The Spreadability test was carried out in in triplicate and the average of the readings was recorded.

Smear type: The test was conducted after the application of vanishing cream on the skin and smear formed was Non-greasy.

Emolliency test: Emolliency of cream was checked by application of fixed amount of cream on skin and found that no residue left after application.

Dilution test: The cream was diluted with water and found stable as water is the dispersion medium indicating o/w type of cream.

Dye solubility test: The cream was mixed with the water soluble dye (amaranth) and observed under microscope. The continuous phase appears red in color, indicating o/w type cream as water is in the external phase and the dye will dissolve in it to give color [14].

Viscosity: The viscosity was determined at 25ºC using a Brookfield Viscometer (DV II+ Pro model), spindle number S-64 at 20rpm speed.

Evaluation of anti-bacterial activity of formulated polyherbal cosmetic cream:

To test the antibacterial activity of newly formulated polyherbal cosmetic cream, the gram-positive bacteria Staphylococcus aureus was selected. Before starting the test, the bacterial strain was cultured in nutrient agar plates and incubated in incubator for 18 to 24 hrs at 37ºC temperature to obtain bacterial colonies. After overnight incubation, colonies on the plates were selected with autoclaved sterile inoculating loop of inoculating needle and transferred it to a glass test tube of sterile physiological saline which was prepared for test and mixed it thoroughly. The growth of bacteria is measured by the turbidity of saline solution. The turbidity of bacterial suspension was compared with 0.5 Mc Farland standard solution which produces turbidity equivalent to 1.5×108 CFU/ml (Colony forming units). Antimicrobial susceptibility of formulated cream was tested by using a well-diffusion method (National Committee for Clinical Laboratory Standards). The formulations were tested on Mueller Hinton plates to detect the presence of bacterial growth. All plates were inoculated with the test bacteria i.e. Staphylococcus aureus which have been previously adjusted to 0.5 Mc Farland standard solution turbidity using pour plate method. The inoculated plates were dried for around 5 mins to remove excess moisture if any in laminar air flow chamber by placing the plates near to burner to avoid any contamination. 50ul aliquots of each test and standard marketed cream with different concentrations (0.1 mg/10ml, 0.2mg/10ml and 0.3mg /10ml) were added into each well after the inoculation of each plate with bacteria. The well was made on agar by using sterilized cork borer. The

plates were sealed, labelled and placed in an incubator at temperature of 37ºC for 24 hours. After 24h of incubation, each plate was observed for inhibition zones. Inhibition zone was measured by using ruler (Scale). The zones were measured in millimetres and the reading was noted down. [15]

Evaluation of anti-fungal activity of formulated polyherbal cosmetic cream:

The fungal organism Saccharomyces cerevisiae was selected to study the anti-fungal activity of prepared vanishing cream. The fungal organism was cultured in Potato dextrose agar medium at 27^{0}C room temperature for 3-5 days. After that the colonies of S. cerevisiae were observed after 5days and they were diluted further and compared with 0.5 Mc Farland which were prepared earlier (which is equal to 1.5×108 CFU/ml). The same procedure of antibacterial activity test were followed for antifungal activity testing of newly prepared cream, only the organism and agar were changed. All plates were inoculated with the test fungi i.e. S. cerevisiae which have been previously adjusted to the 0.5 Mc Farland standard solution by pour plate method in PDA medium. Cream anti-fungal susceptibility was tested by using well-diffusion method (National Committee for Clinical Laboratory Standards). 50 µl aliquots of each test and standard marketed cream formulations with different concentrations (0.1 mg/10ml, 0.2mg/10ml, and 0.3mg/10ml) were added into each well after the inoculation of the plates with fungi. The well was made on agar by using sterilized cork borer. The plates were sealed, labelled and placed in an incubator set at 22^{0}C for 4-5 days. After 5 days of incubation, each plate was observed for inhibition zones. Inhibition zone was measured by using ruler (Scale). The zones were measured in millimetres and the reading was noted down.

Results and discussion:

Preliminary phytochemical screening:

The results indicate that alkaloid and tannins are present in extracts of all the herbs. Flavonoids are present in the extracts of Curcuma longa, Terminalia chebula, Terminalia bellirica, Aloe barbadensis Mill. Saponins are present in the extracts of Ocimum sanctum Linn and Aloe barbadensis. Steroids are present in the extracts of Ocimum sanctum Linn and Terminalia chebula. Triterpenes are present in Curcuma longa, Ocimum sanctum Linn, Terminalia chebula and Aloe barbadensis Mill (table 1).

Table 1: Preliminary phytochemical screening of alcoholic extracts

S.N.	Plant Part	Alkaloid	Tannin	Flavonoid	Saponin	Steroid	Triterpene
1.	**Turmeric** *(Curcuma longa)*	+	+	+	-	-	+
2.	**Tulsi** *(Ocimum sanctum Linn*	+	+	-	+	+	+
3.	**Amla** *(Phyllanthus emblica Linn)*	+	+	-	-	-	-
4.	**Hirda** *(Terminalia chebula)*	+	+	+	-	+	+
5.	**Behada** *(Terminalia bellirica)*	+	+	+	-	-	-
6.	**Aloevera** (Aloe barbadensis Mill*)*	+	+	+	+	-	+

The pharmaceutical, cosmetic, neutraceutical industries are using flavonoids in preparation of their products as flavonoids have been reported to inhibit the production of superoxide radicals[16, 17], to suppress lipid peroxidation[18], a process responsible for inflammation, along with ageing[19,20]. Serum flavonoid content of flavonoids improves dermal microcirculation, enhancing supply of oxygen and nutrients to the skin, leading to improved skin structure, texture, and water homeostasis[21]. Flavonoids reduce protect skin by absorbing UV rays and provide a sunscreen effect [22].

Physical analysis of formulated cream:

The prepared formulation comply with parameters as per official guidelines[23, 24, 25] and the results are presented in Table 2.

Table 02: Evaluation of formulated cream for physical parameters

S. No.	Physical parameters	Test formulation
1.	Appearance	Smooth and shiny
2.	Colour	Greenish white
3.	Odour	Pleasant
4.	pH	7.5
5.	Homogeneity; By visual and touch	Graceful
6.	Spread ability	10sec.
7.	Type of Smear	Non-greasy
8.	Emolliency	No residue left
9.	Viscosity	27025cps
10.	Dilution test	o/w type
11.	Dye solubility Test	o/w type

The results mentioned in table no. 02 indicate that the formulated cream passes the physical parameter tests as per official guidelines [23,24,25].

Antibacterial and antifungal activity of polyherbal cosmetic cream

The formulated polyherbal cosmetic cream was evaluated for antibacterial activity against gram positive *S. aureus,*. The antifungal activity was tested against Saccharomyces cerevisiae. The results of antibacterial activity were compared with marketed formulation (Table 3 and Figure 1-6). It showed maximum growth of inhibition at 0.3mg/10ml concentration. The prepared cream exhibited better antibacterial activity against *S. aureus* (9 mm) than marketed formulation (8 mm). It also exhibited maximum antifungal activity (12mm) at 0.3mg/10ml concentration. The results shows that the prepared formulation acts as an effective antibacterial, antifungal cream (Table 3 and Figure 1-6). The exhibited antibacterial and antifungal activities may be attributed due to presence of bioactive phyto-constituents of 6 herbs used in the prepared formulations.

Table 03: Antibacterial and antifungal activity of vanishing cream

Sr. No	Concentration (mg/10ml)	Extent of inhibition (mm)		
		Staphylococcus aureus		Saccharomyces cerevisiae
		Test	Marketed	Test
1	0.1	5	4	9
2	0.2	8.5	6	10.5
3	0.3	9	8	12

Fig 1-3: Evaluation of Antibacterial activity of formulated cream

S.aureus (0.1 mg/ml)

Fig:1

S.aureus (0.2 mg/ml)

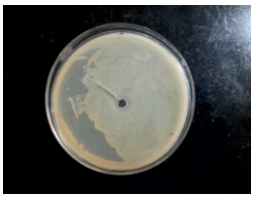

Fig:2

S.aureus (0.3 mg/ml)

Fig:3

Fig 4-6: Evaluation of antifungal activity of formulated cream

S.cerevisiae (0.1mg/ml)

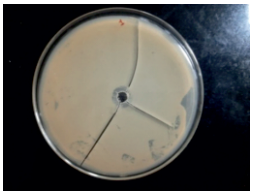

Fig:4

S.cerevisiae (0.2mg/ml)

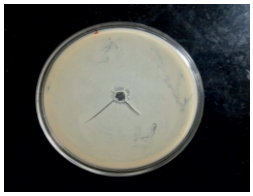

Fig:5

S.cerevisiae (0.3mg/ml)

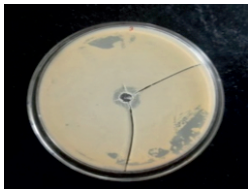

Fig:6

Conclusion:

In the present study polyherbal cosmetic cream was formulated, evaluated for various physical parameters, antibacterial and antifungal activities. The results indicated that the formulations passed pharmaceutical physical parameters and exhibited significant antimicrobial and antifungal activities. The formulated polyherbal cream provides nourishment, moisture and protect the skin against various environmental factors due to the presence of various phyto-constituents present in the extracts of six herbs used in the preparation of cream.

Conflict of Interest: Nil

Source of Support: Nil

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