Research Article

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DEVELOPMENT AND EVALUATION OF HERBAL ANTI-INFLAMMATORY CREAM CONTAINING TURMERIC

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ABSTRACT

Curcuma longa, also known as turmeric, is a *Zingiberaceae* plant whose rhizomes are used to make the spice. Curcumin is well known for its anti-inflammatory qualities and skin-protective characteristics. Curcumin has long been used to treat skin infections and inflammation in natural herbal medicines. The purpose of this project is to formulate a turmeric-based anti-inflammatory cream. The herbal cream was created utilizing the primary emulsion method. Different physiochemical tests were performed on the turmeric cream, including drug content, spreadability, viscosity, appearance, homogeneity, grittiness, viscosity, pH measurement, and anti-inflammatory action. The study's findings of various physicochemical properties were determined to be satisfactory and consistent with the commercially available turmeric cream. The data was acceptable and in line with the commercial product.

Key words: Turmeric, Anti-inflammatory, Cream

INTRODUCTION

Turmeric (the rhizome of *Curcuma longa* L., Zingiberaceae) is also known as Haldi in Hindi, documented in various ancient traditional books [1]. The Indian subcontinent is widely used as a food pigment and spice. It has traditionally been used to treat many disorders affecting the skin, lungs, and gastrointestinal system, as well as pains, wounds, sprains, and the liver. Curcumin is responsible for most of the actions linked with turmeric, according to a significant study conducted over the last half-century [2,3] (Figure 1). Curcuminoids, including a combination of curcumin, demethoxycurcumin, bis-dismethoxycurcumin, volatile oils (turmerone and zingiberone), sugars, proteins, and resins, have all been isolated from the rhizome of *Curcuma longa* [4,5].

The proposed aim of this work was to formulate a w/o type cream containing turmeric as the main ingredient and standardize both the formulated and marketed product.

MATERIALS AND METHODS

Standard reference compound curcumin was purchased from Natural Remedies Pvt. Ltd., Mumbai, India. All other chemicals and reagents used in the study were analytical grade with high purity.

Plant Material: Curcuma longa extract from Finar chemicals limited, Ahmedabad, Gujarat, India. Aloe vera plant was collected from the medicinal garden of Ganpat University, Mehsana, Gujarat, and identified as Aloe vera by the Department of Botany, Ganpat University, Mehsana, Gujarat.

Preparation of Cream: Beeswax, propylene glycol, cetyl alcohol, stearic acid and olive oils were mixed at 75 ^{0}C ± 2 with constant stirring using a hot plate. Methylparaben, propylparaben and aloe vera gel were mixed in purified water with continuous stirring using a hot plate at 75 ^{0}C ± 2. The aqueous phase was added gradually in the oily phase with continuous triturating in a mortar with a pestle till smooth thick cream was obtained. The extract of turmeric was added with triturating to get the desired product. The cream was preserved in a dark glass bottle to protect it from sunlight till further process.

Evaluation of Cream

Physical evaluation: Colour odour, texture, and state were observed under physical evaluation [6].

Irritancy: On the left-hand dorsal surface, make a 1 cm^2 mark. The cream was then sprayed on the specified area, and the time was recorded. Then, for up to 24 hours, it is evaluated for irritancy, erythema, and oedema, if any, and reported.

Washability: A small quantity of cream was applied to the hand and then washed with tap water to check its washability.

pH: 10% aqueous solution of both formulations was prepared, and measured the pH of the resulting solution[7].

Viscosity: The viscosity of formulated and marketed cream was measured using Brooke field viscometer [8].

Phase separation: Formulated and marketed creams were maintained in a sealed jar and away from light at 25-100 ^{0}C. After that, phase separation was tested for 24 hours to 30 days [8].

Spreadability: A pair of glass slides was taken, and cream was placed between them. A fixed amount of pressure was applied to them, and record the time taken by a slide to move away from each other was noted. The weight was then kept away, and any excess product stuck on the slides was scraped. The force of weight attached to the upper slide allowed it to glide off effortlessly [9].

Spread ability= m × l/t

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

Grittiness: Formulated and marketed cream was observed under a microscope to find out any gritty particles [10].

Qualitative analysis of Curcumin in formulated and marketed cream by TLC method

Precoated Silica gel F254 aluminium plates (20 X 20cm) were used for thin-layer chromatographic studies of curcumin. The Curcumin was separated using Dichloromethane: Methanol [9:1]. The colour and Rf values were recorded using spraying the plates with 1% alcoholic KOH solution.

Quantitative analysis of curcumin in formulated and marketed cream by UV spectroscopic method

Preparation of standard solution: 100 µg/ml of stock solution was prepared by dissolving 10 mg of curcumin in 100 ml of methanol. Working standard solutions in the range of 10-50 µg/ml were prepared using stock solution [8,9].

Determination of maximum wavelength of curcumin: In the range of 200-800 nm, 50 µg/ml solution of curcumin was scanned in a double beam UV-Spectrophotometer [11, 12].

Preparation of standard calibration curve of curcumin: The absorbance of the standard working solution (10-50 µg/ml) was measured at 425 nm and plotted a graph of absorbance against concentration to an obtained standard calibration curve of curcumin.

Preparation of test solution:1 gm of formulated and marketed cream was accurately weighed and dissolved in 10 mL methanol. The resulting solution was used for analysis.

Transdermal Absorption Studies

The study used a 10 cm × 2.3 cm diameter diffusion cell. 2.5 gm of abdominal rat skin was connected to the diffusion cell in such a way that the cream covered the diffusion cell's inner surface. The diffusion cell was placed in a 250 mL beaker with 100 mL of pH 7.2 buffer. The medium was swirled at a consistent speed with a magnetic stirrer to ensure uniform mixing. 2 ml of sample was withdrawn every 15 min up to 180 minutes and replaced with a new medium into the cell to keep the medium level constant. At 37°C ± 0.5 ^{0}C, the entire diffusion cell was placed in the organ broth. The curcumin concentration in these withdrawn samples was determined using UV spectroscopy [13].

Anti-Inflammatory activity of Formulated and Marketed Cream

Experimental Design

Healthy adult male Wistar rats weighing 150 – 200 gm were used. Rats were housed in polypropylene cages, maintained under standard conditions (12-h light/dark, 24 ^{0}C, 35 to 60% humidity) and provided free access to palleted CHAKKAN diet (Nav Maharashtra Oil Mills Pvt. Ltd. Pune, India) and purified drinking water ad libitum.

CPCSEA and IAEC approved the study protocol of Shree S. K. Patel College of Pharmaceutical Education and Research, Kherva, Mehsana, India (Protocol no. SKPCPER/IAEC/2013-02/10).

The anti-inflammatory activity of formulated and marketed cream was evaluated using the carrageenan-induced rat paw oedema model. The animals were divided into four groups, each group comprising four animals (Table 2).

The cream was carefully rubbed 50 times into the plantar surface of the left hind paw. After three hours of applying the cream, the treated paw was injected subplantarly with 0.1 mL of a 1% carrageenan in normal saline. After three hours, the rats were anaesthetised using ketamine/xylazine, and under this condition, both paws were excised and weighed individually. The severity of inflammation was concluded by calculating the % increase in paw weight of inflamed paw as compared to non-inflamed paw using the following formula[4-6].

% increase in paw weight = (L x R / L) x 100

Where: R is the weight of right leg, L: is the weight of left leg.

The mean percentage of inflammation reduction was measured from the difference in % swelling between treated groups and the control group by the following equation:

% reduction of edema = (C x T / C) x 100

Where: C = % swelling of control group (untreated), T = % swelling of treated group.

RESULT AND DISCUSSION

Physical evaluation: Colour, odour, texture and state of formulated and marketed creams were evaluated, and both have yellow to orange colour, smooth texture, semi-solid (Table 3).

Irritancy: Formulated and marketed turmeric cream were applied for 24 hours, and it was observed that there was no sign of irritancy, erythema, and oedema (Table 3).

Washability: It was observed that formulated and marketed creams were easily washable under tap water (Table 3).

pH: 10% aqueous solution of formulated and marketed cream had a pH of 7.0-8.0 (Table 3).

Viscosity: The results suggested that formulated and marketed creams had an adequate viscosity (Table3).
Phase separation: The formulated and marketed cream was evaluated at different temp (25-100 ^{0}C) in a closed vessel for 24 hours to 30 days, and it was observed that there was no phase separation in the formulation.

Spreadability: The spreadability of formulated and marketed creams was tested, and it was observed that formulated cream has the same spreadability as marketed cream.

Grittiness: No, gritty particles were found while observing under the compound microscope.

Qualitative Analysis

TLC study for formulated cream was carried out, and by comparing the R_f values of standard turmeric extract, marketed turmeric cream extract and formulated cream extract, from the above results, where the R_f value of all extracts was 0.9, hence it was observed that the formulated cream contains the appropriate amount of curcumin to provide the healing effect (Table 4) (Figure 2).

Table 1: Composition of Cream Formulation

Ingredients	Uses
Petroleum jelly	Emollient
Propylene glycol	Heat transfer fluid
Methylparaben	Preservative
Propylparaben	Preservative
Olive oil	Anti-scaring
Stearic acid	Fatty acid
Cetyl alcohol	Emulsifying agent
Aloe vera juice	SPF agent
Turmeric extract (Methanolic) (2%)	Active ingredient
Distilled water	Vehicle

Table 2:Animal Grouping for Anti-inflammatory Activity

Group	Treatment and Dose
Control Group	Received 2 g of Cream base only.
Treatment Group 1	Received 2 g of commercial diclofenac gel
Treatment Group 2	Received 2 g of Turmeric formulated cream
Treatment Group 3	Received 2 g of Marketed Turmeric Cream

Each group comprise n=4

Table 3: Evaluation of cream

Physico-Chemical Parameter	Observation
Colour	Yellow-orange colour
Texture	Smooth
State	Semisolid
Irritancy	No irritancy, erythema or oedema was observed
Washability	Good
pH	7.0-8.0
Viscosity	Appreciable range
Phase Separation	No phase separation was observed
Spreadability	Good and easily spreadable
Greetiness	No gritty particle found

Table 4: Comparison of R_f value between standard cream and formulated cream

Samples (extract)	Sample front (cm)	R_f value
Standard Curcumin	9.0	0.9
Marketed turmeric Cream	9.0	0.9
Formulated cream	9.0	0.9

Table 5: Drug release of marketed turmeric cream

Time (Min)	Abs.	(Conc.) mcg/ml	(Conc.) mg/ml	(Conc.) in 0.2 ml	(Conc.) in 12ml	Cumulative (Conc.)	% Drug release
15	0.198	24.57	0.025	0.005	0.295	0.295	14.74
30	0.262	33.71	0.034	0.007	0.405	0.409	20.47
45	0.334	44.00	0.044	0.009	0.528	0.535	26.74
60	0.446	60.00	0.060	0.012	0.720	0.729	36.44
90	0.577	78.71	0.079	0.016	0.945	0.957	47.83
120	0.697	95.86	0.096	0.019	1.150	1.166	58.30
150	0.834	115.43	0.115	0.023	1.385	1.404	70.22
180	0.841	116.43	0.116	0.023	1.397	1.420	70.01

Table 6: Drug release of formulated cream

Time (Min)	Abs.	(Conc.) mcg/ml	(Conc.) mg/ml	(Conc.) in 0.2 ml	(Conc.) in 12ml	Cumulative (Conc.)	% Drug release
15	0.098	10.28	0.01	0.002	0.123	0.123	6.17
30	0.162	19.42	0.01	0.003	0.233	0.235	11.76
45	0.234	29.71	0.029	0.005	0.356	0.360	18.02
60	0.343	45.28	0.045	0.009	0.543	0.549	27.46
90	0.453	61	0.06	0.012	0.732	0.741	37.05
120	0.546	74.28	0.07	0.014	0.891	0.903	45.18
150	0.714	98.28	0.098	0.019	1.179	1.194	59.71
180	0.734	101.14	0.101	0.020	1.213	1.233	61.66

Table 7: Anti-inflammatory activity

Treatment	Mean % increase in paw weight (gm)	% Reduction of oedema
Cream Base (Control)	34.5 ± 1.1	0.0
Marketed Diclofenac Emulgel	18.3 ± 1.5	47.0 ± 0.8
Formulated Cream	20.2 ± 1.3	40.1 ± 1.1
Marketed Turmeric Cream	16.7 ± 1.8	42.8 ± 1.6

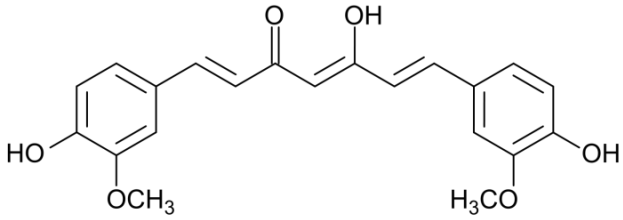

Figure 1: Structure of Curcumin

Figure 2: TLC fingerprinting
Where; S – Standard Curcumin, L.F. – Lab Formulation, M – Marketed Turmeric Cream

Quantitative analysis of Curcumin in Formulated and Marketed cream by UV Spectroscopic method

The formulated cream was analyzed quantitatively for the assay by UV spectrophotometer, and from the results, it is observed that the formulated cream has 68.86% w/w and the marketed turmeric cream has about 86.57% w/v curcumin, which shows that the formulated cream has an appropriate quantity of the drug to give the effect.

Transdermal absorption studies

Diffusion study of prepared and marketed creams performed using abdominal rat skin in pH 7.2 buffer for 180 minutes. The results of marketed and formulated cream show that after 150 minutes, the drug release was found to be 70.01 % and 59.71 %, respectively (Table 5 and 6). The study indicates the competitive performance in terms of drug release.

Anti-inflammatory activity

As indicated in Table 7, the formulated turmeric cream reduced oedema by 40.1 %, approximately as efficient as the Marketed Turmeric Cream (42.8 %), showing a similar anti-inflammatory action.

CONCLUSION

Turmeric cream formulation demonstrates good physicochemical properties comparable to the marketed formulation. The release of active constituents is effective as anti-inflammatory formulations based on the carrageenan-induced rat paw oedema method. Future clinical studies can be proven vital for its effective usage**.**

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