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FORMULATION AND CHARACTERIZATION OF POLYHERBAL TOPICAL GEL CONTAINING *JASMINUM GRANDIFLORUM*, *CYNODON DACTYLON* AND *ANDROGRAPHIS PANICULATA*

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ABSTRACT

Medicinal and aromatic plants and their combinations have been shown to have medicinal and cumulative effects in healthcare. In light of this, a polyherbal topical gel formulation based on plant extracts was developed to improve patient compliance, broaden the antibacterial spectrum, and improve cosmetic characteristics. The goal of this research was to develop and characterize a topical polyherbal gel for the delivery of active plant ingredients to treat skin disorders. For the formulation of topical gel, plant extracts of *Jasminum grandiflorum* (JG), *Cynodon dactylon* (CD), and *Andrographis paniculata* (AP) were used. Different formulation batches (F1 and F2) were created using carbapol-934 as a gelling agent at various concentrations. The pH, appearance, and homogeneity of the polyherbal gel formulation, as well as its viscosity, spreadability, and skin irritation tests, were all examined. All physicochemical parameters of the developed polyherbal cream were determined to be stable.

Keywords: *Jasminum grandiflorum, Cynodon dactylon, Andrographis paniculata*, Polyherbal gel

INTRODUCTION:

India's herbal medicine industry is perhaps the world's oldest medical care system. Herbs have such a long history in vedic Period that they are even listed in the Vedas, an ancient Hindu sacred text. Ayurveda and Unani, two ancient herbal medicine systems, deal with using plants and natural materials to treat health

problems. In recent years, there has been a significant surge in global demand for herbal remedies, herbal skin care products, and even herbal cosmetics **[1]**. Topical preparations containing plant extracts may effectively neutralize free radicals in the skin, therefore delaying skin ageing by minimizing wrinkles, guarding against UV radiation, and preventing collagen degradation. As a result, the use of herbal substances in skincare formulations aids in reducing the generation of free radicals in the skin and ensuring long-term results **[2]**.

Plants like JG, CD and AP have a wide range of possible therapeutic properties in traditional medicine and are high in phytoconstituents. Many pharmacological actions have been documented for the leaves of JG including antiinflammatory, anthelmintic, and antioxidant activity **[3-4]**. CD aerial parts have immunomodulatory, antihepatotoxic and antioxidant properties **[5]**. Analgesic, anticancer, antidiabetic, antifertility, antiinflammatory, antimalarial, antimicrobial, antioxidant, antipyretic, and antimicrobial are only a few of the properties of AP leaves and stem **[6]**.

Furthermore, these therapeutic herbs are widely available, inexpensive, and widely used by humans. Taking these aspects into account, the current study was created to develop a new polyherbal gel containing extracts of JG, CD and AP.

MATERIALS AND METHODS

Plant Material and chemicals

Leaves of JG and aerial parts of CD were obtained from a home garden in Koradi village, Nagpur, India, and leaves of AP were collected from Kamla Nehru College of Pharmacy's medicinal plant garden in Butibori, Nagpur. The specimens of above plants were confirmed and authenticated by Dr. N.M. Dongarwar, Associate professor, Department of Botany, Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur, India. Herbarium voucher specimens RTMNU/10570, 10571, 10572 were made and certified for CD, JG, and AP respectively, and maintained in the University for Future Reference. Loba Chemie in Mumbai provided the chemicals and is of a high analytical quality.

Preparation of plant extract

Leaves of JG, AP and CD aerial parts were cleaned in water to remove dirt and unwanted particles, then air dried in the shade at room temperature. The air dried plant materials were coarsely pulverized and individually treated to ethanol extraction using a soxhlet apparatus at 60 °C for 6 hours. The extracted extracts were filtered, dried to a semi-solid paste, and stored in the refrigerator for further research **[7]**.

Preparation of topical gel

Dried methanolic extracts of JG, AP, and CD as well as Carbapol-940 (1%), propylene glycol 400, methyl paraben,

propyl paraben, EDTA and tri-ethanolamine were used to make the polyherbal gel, which was then diluted to 100 g by adding sufficient distilled water. The distilled water used in this experiment was split into two halves. The exact amount of extract was dissolved in one part propylene glycol 400 and ethanol was added to this calculated proportion. The carbapol -940 was dissolved in the second component, and then methyl paraben, propyl paraben, and EDTA were added. Both of these components were combined in a beaker, then tri-ethanolamine was added dropwise to achieve gel consistency **[8]**. **Table 1** shows the polyherbal gel's composition.

Table 1: Composition of different formulation of polyherbal gel

Ingredients	Quantity taken in (%) for gel base	Quantity taken in (%) for F1	Quantity taken in (%) for F2	Quantity taken in (%) for F3	Role
Carbopol 940	1.0	1.0	1.0	1.0	Gelling agent
Each crude drug extract	---	0.2	0.4	0.6	Crude drug
Propylene glycol 400	4.0	4.0	4.0	4.0	Base
Ethanol	3.0	3.0	3.0	3.0	Solvent
Methyl paraben	0.2	0.2	0.2	0.2	Preservative
Propyl paraben	0.02	0.02	0.02	0.02	Preservative
EDTA	0.03	0.03	0.03	0.03	Chelating agent
Triethanolamine	1.2	1.2	1.2	1.2	pH adjustment
Water	q.s.100 g	q.s.100 g	q.s.100 g	q.s.100 g	Aqueous base

Evaluation of the gel

Physical characteristics

The appearance and clarity of all of the produced gels were checked.

pH measurement

1 g of each gel formulation was put into a 10 mL beaker and measured with a digital pH metre to determine pH **[9]**.

Viscosity

Using a Brookfield viscometer RVDV-II+Pro and a spindle T bar (S96), The viscosity of the gel that was developed was calculated. The viscosity measurements were recorded after 10 ml of gels were rotated at 100 rpm **[10]**.

Spreadability

It denotes the size of a region across which the gel glides easily when applied to the skin or damage part of skin. A formulation's medicinal impact is also influenced by its spreading value. It is measured in seconds and expressed as the time it takes for two slides to fall off the gel. About 1 g of gel has been sandwiched between two slides, then the time it took to separate the slides was recorded. About 1 g gel is applied among the two slides towards

the direction of a specified weight, which minimises the time taken by it to separate the two slides and promotes spreadability **[11]**.

It was calculated using the formula below:

S= M x L/T

Where S – Spreadability, L – Length travelled by the glass slide, M – Weight T – Time (in s) it took to separate the slides completely

Extrudability

It was utilised to determine the gel's ability to be extruded from a collapsible tube. The gel-filled collapsible tube's crimp end was squeezed in. The gel eject out till the force was released when the cap has been separated. In 10 s, the weight in grams necessary for a 0.5 cm gel ribbon was measured. The average extrusion pressure is measured in g and recorded **[12]**.

Bioadhesive strength

This relates to how well the gel adheres to the skin. To assess bioadhesive strength, using double-sided adhesive tape, different specimen of topical gel have been adhered to the bottom of a glass vial that had been inverted. The distance between these two vials was selected so that the gel sample stayed attached to the goat skin's mucosal barrier.

To facilitate effective attachment of the gel to the mucosa, for 10 s, adequate pressure was applied to both sides of the vial. A continuous weight is attached to the other arm of the new balance in the pan, pushing the vial away from the other vial. It was noted how much force was necessary to separate the two vials. The mucoadhesive force, which was reported as the detachment stress in dynes/cm^2, was computed using the lowest weight which detaches the mucous membrane tissue from the surface of every formulation **[13]**.

It was calculated using the following formula:

Mg / A = Bioadhesive strength (dynes/cm^2)

Where M - Weight necessary to separate in grams and

g - Gravitational acceleration (980 cm/s^2).

A – Area of exposed mucosa.

Stability studies

The stability of a medicine in a dosage form under various environmental conditions is critical since it influences the formulation's expiry date. It is indicated by alterations in the formulation's physical attributes, colour, odour, and consistency. For one month, the gels were treated to temperatures of 0 °C, room temperature (27±2) °C, and (40±2) °C. Specimen was taken at regular intervals (originally 15 days, then up to 30 days) **[14]**. **Table 1** summarizes the evaluation parameters for the formulations F1, F2, and F3.

RESULTS AND DISCUSSIONS

Physical Characteristics

Topical polyherbal preparations had a whitish sticky creamy texture and a shiny look. **Table 2** is a summary of the findings.

pH Measurement

The pH of the polyherbal gel formulations was determined to be between 7.0 to 7.5, and a comparative study with a standard gel was conducted, as shown in **Table 3**.

Viscosity

The gel compositions had viscosities ranging from 18900 to 22120 cps. **Table 4** displays the results.

Spreadability

The spreadability of the formulations (F1, F2, and F3) was investigated and found to be between 8.7±0.06 to 9.8±0.04 g.cm/s. As indicated in the **Table 5**, all of the formulations had good spreadability.

Bioadhesive strength

The modified physical balance method was used to test the bioadhesive strength of all the produced formulations. **Table 7** shows that the bioadhesive strength of topical formulations was determined to be between 4221±0.20, 4623±0.12, and 4371±0.18 dynes/cm^2 for F1, F2, and F3, respectively. Good bioadhesive strength was sought for improved adhesion and longer duration of action, according to the study's requirements.

Extrudability

The extrudability of the formulations (F1, F2, and F3) was investigated and found to be good and shown in **Table 6**.

Stability studies

The physical appearance, colour, odour, and texture of a medicine in a dosage form under different environmental circumstances are essential since it impacts the drug's stability. **Table 8** shows the results of stability tests.

Washability

The convenience and intensity of cleansing with freshwater were personally examined after the preparations were applied to the skin. Because of its non-greasy qualities, all of the preparations were easily washable and leave no residues on the skin when washed **[14]**.

Table 2: Physical characteristics of prepared Polyherbal gel

Polyherbal gel	Consistency	Colour	Clarity	Phase separation
F1	Excellent	Whitish	Good	None
F2	Excellent	Whitish	Good	None
F3	Excellent	Whitish	Good	None

Table 3: pH of prepared Polyherbal gel

Polyherbal gel	pH (mean± SD)
F1	7.3±0.18
F2	7.1±0.20
F3	7.2±0.16

Table 4: Viscosity of prepared Polyherbal gel

Polyherbal gel	Viscosity cps
F1	18900
F2	20230
F3	22120

Table 5: Spreadability of prepared Polyherbal gel

Polyherbal gel	Spreadability(mean± SD)
F1	8.7±0.06
F2	9.2±0.08
F3	9.8±0.04

Table 6: Extrudability of prepared Polyherbal gel

Polyherbal gel	Extrudability (mean± SD)
F1	10.5±0.04
F2	10.2±0.07
F3	11.4±0.03

Table 7: Bioadhesive strength of prepared Polyherbal gel

Polyherbal gel	Bioadhesive strength (mean± SD)
F1	4221±0.20
F2	4623±0.12
F3	4371±0.18

Table 8: Stability studies of F1, F2 and F3 at 0 °C, (27±2) °C, and (40±2) °C (75% RH).

Polyherbal gel	Physical appearance	Consistency	pH	Result
F1	No change	No change	No change	Accepted
F2	No change	No change	No change	Accepted
F3	Color change	-	-	Rejected

CONCLUSIONS

From the above study we have concluded that the generated polyherbal formulations F1, F2, and F3, which contained ethanolic extracts of *Jasminum grandiflorum*, *Cynodon dactylon*, and *Andrographis paniculata* in concentrations of 0.2, 0.4, and 0.6 percent respectively, were found to be within the neutral pH range, which is compatible with skin. The viscosity, spreadability, extrudability and bioadhesive strength was found to be appropriate for topical delivery of drug. The gels remained stable at all temperatures with just minor variations, in stability studies indicating that the prepared polyherbal topical gel is of acceptable quality.

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