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FORMULATION OF POLYHERBAL GEL OF HYDROALCOHOLICEXTRACT *BASELLA ALBA, BOERHAVIA DIFFUSA,* AND *KAEMPFERIA GALANGAL*

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ABSTRACT

The antibiotic used to treat acne may produce unwanted side effects and antibiotic resistance. Polyherbal formulations are herbal preparations that incorporate a variety of therapeutically effective plant extracts. Thus this study aims at utilizing the synergistic medicinal effect of *Basella alba*, *Boerhavia diffusa*, and *Kaempferia galanga* in form of gel. The colour of all formulations was observed to be brown.For the formulations F1 to F5 the transparency& consistency was appreciable with zero sediments. But F6 reported to have sediments with thin and runny consistency. The washability of formulation fromF1 to F5 was better but for F6 it retained minimal residue after rinsing.Extrudability ranged from158±4 to 196±3 g.The pH range observed in this case varied from 6.5±0.1 to 6.9±0.3. Further maximum drug content of 0.785 was observed in F4 formulation. The anti -acne activity of F4 formulation was checked by well diffusion method using marketed formulation named Clintop gel as standard. In case of Clintop gel at 100µg/ml the zone of inhibition was recorded as16±0.57 mm while in case of polyherbal gel at 100mg/ml concentration the zone of inhibition for F4 was noted as 17±0.5mm. Thus, the formulation of gel F4 had a synergistic effect of all plant extracts were used to treat mild acne vulgaris.

Keywords: Medicinal plants, *P.acne*, Polyherbal gel, *Basella alba*, *Boerhavia diffusa*, and *Kaempferia galangal***.**

Conclusion: Thereissignificantincreaseinrunningspeedofrecreationalrunners,alongwith significant decrease inpain,

Keywords: iliopsoas muscle, recreational runners, running speed, muscle release

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Introduction

Almost everyone experiences acne vulgaris at least once in their lifetime, and the frequency of breakouts is directly correlated with sebum production, which is brought on by inflated sebaceous glands in response to androgenic stimulants. The aetiology of acne was discovered to involve a number of physiological elements, including follicular hyper proliferation and increased sebum production, which were followed by follicle obstruction and the colonisation of different bacteria, including Propionibacterium acnes (Yang*et al*., 2020; Well, 2013).

To solve this issue, several synthetic antibiotic medications are employed, including clindamycin, doxycycline, and minocycline. The first-line method of treatment with benzyl peroxide and retinoids is typically topical therapy. However, given the rising use of antibiotics and their negative effects, attention should be paid to the study of herbal medicines. Due to the medicinal plant's apparent safety and low risk of side effects, interest in its use has gradually grown in recent years.Traditional medicine has long served as a valuable source of novel chemicals that may be used in the development of chemotherapeutic agents, and nature also contributes to an incredible number of sources from which contemporary medications have been separated (Fox*et al*., 2016; Kumar et al., 2008).

Polyherbal formulations are herbal preparations that incorporate a variety of therapeutically effective plant extracts. The low toxicity, fewer adverse effects, and potential therapeutic benefits of these formulations, which have been utilised in traditional medicine for many years, have reignited interest in modern medicine (Kushwaha*et al*., 2017; Baitule*et al*., 2023). Polyherbal gels are topical preparations that combine a variety of plant extracts in a foundation of gel to make them easier to apply to the skin. Numerous research have looked into the usage of multi-herbal gels to treat acne vulgaris. This study involves use of three plants namely *Basella alba*, *Boerhavia diffusa*, and *Kaempferia galanga*.

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- The plant *Basella alba* known for phytoconstituents like Basellasaponins, kaempherol, betalin, and other substances are some of those that are particularly present in the plant. For various pharmaceutical purposes, extracts such as aqueous, chloroform, ethanol, and petroleum have been employed (Deshmukh *et al.*, 2014). In case of plant*Boerhaavia diffusa* the Indigenous and tribal people in India have traditionally used the entire plant or specific parts of it (the leaves, stem, and roots) for medicinal purposes. Diabetes, stress, dyspepsia, gastrointestinal pain, inflammation, jaundice, spleen enlargement, and congestive heart failure are all conditions that *B. diffusa* is used to treat in Ayurvedic medicine in India and Unani medicine in Arab nations (Ghosh,2018). Further *Kaempferia galanga* is renowned for both its medicinal and culinary uses since it is a source of valuable bioactive chemicals. The rhizome of *K. galanga* L. is used in folk medicine as an antibiotic, treatment for hypertension, asthma, rheumatism, indigestion, cold, and headache, as well as for relieving toothache and abdominal pain (Khairullah *et al.*, 2021). Thus this study aims at utilizing the synergistic medicinal effect of these plants against acne in the form of polyherbal gel.

Materials & method

Procedure:

Take 1% of each herbal extract (*Basella alba, Boerhavia diffusa,* and *Kaempferia galanga*) in a clean mixing bowl, combine prepared herbal extracts with a small amount of distilled water. Mix well until a uniform paste is formed. Add the gel-forming agent (carbopol 934P) gradually to the herbal paste. Stir continuously to avoid lumps and ensure even dispersion

The amount of gel-forming agent will depend on the desired viscosity and consistency of the gel. Follow the manufacturer's guidelines for the recommended concentration. Ensure not to overheat the mixture to avoid damaging the active constituents of the herbs. Once the gel-forming agent is fully dissolved, allow the mixture to cool to room temperature. Adjust the pH of the gel if necessary. Use a pH meter to measure the pH of the gel and add small amounts of pH adjust (Triethanolamine) to achieve the desired pH range, typically between 6.8 and 7.0. Add preservatives (Benzyl alcohol) to the gel to prevent microbial growth and increase its shelf life. After all the ingredients are thoroughly mixed, transfer the gel to suitable storage containers (airtight jars or tubes) and store the gel in a cool, dry place away from direct sunlight. Perform stability tests to ensure the formulation remains stable over time.

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Table 1:Formulation optimization of polyherbal gel

Ingredients	F1	F2	F3	F4	F5	F6
***Basella alba* (%)**	1	1	1	1	1	1
***Boerhavia diffusa* (%)**	1	1	1	1	1	1
***Kaempferia galanga* (%)**	1	1	1	1	1	1
Carbopol 934P (%)	0.25	0.50	0.75	1.0	1.25	1.5
Benzyl alcohol (%)	0.2	0.2	0.2	0.2	0.2	0.2
Triethanolamine	Qs.	Qs.	Qs.	Qs.	Qs.	Qs.
Distilled water (ml)	100	100	100	100	100	100

Evaluation of polyherbal gel

Appearance and consistency

Visual inspection of the polyherbal gel formulations' physical appearance was done to determine their texture and appearancePrepared gel was checked for transparency or clarity of the gel. It should be free from any visible particles or cloudiness.Note the presence of any sediments or precipitates, which may indicate ingredient separation or instabilityAssess the texture and feel of the gel by applying a small amount to the skin or by taking a sample on a spatula.Note the viscosity or thickness of the gel. It should have a consistency suitable for its intended application (e.g., easy to spread for topical use).Evaluate the gel's ability to maintain its shape and resist deformation when squeezed or spread and check for any signs of separation or phase separation, such as oil droplets or water pooling on the surface (Soni*et al.*, 2018).

Washability

Apply a small amount of the gel to the skin or a suitable surface, following the recommended usage instructions. Allow the gel to dry or adhere to the skin as per the recommended duration. Wet the area with water and gently massage or rub the gel to simulate the washing process. Assess the ease of removal of the gel from the skin or surface during rinsing (Chandrasekar & Kumar, 2020). Note any residue left behind. Evaluate the skin or surface after rinsing for any remaining traces of the gel. Look for any stickiness, film, or greasiness. Note the skin feel after rinsing. Evaluate if the skin feels clean, refreshed, and free from any tackiness or residue.

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Extrudability determination of formulations

Ensure that the polyherbal gel is stored and handled according to the recommended conditions to maintain its integrity. Select the appropriate packaging for the gel, such as a tube that allows controlled dispensing. Hold the packaging in a vertical position, with the dispensing opening facing downward. Squeeze the packaging gently to dispense the gel in a controlled manner. Observe the flow and extrusion of the gel. It should be within a reasonable range for ease of use. Repeat the process multiple times to evaluate the consistency of the gel's extrudability. Consider factors such as viscosity, gel formulation, packaging design, and gel storage conditions when assessing the extrudability.

Determination of Spreadability

Two glass slides with conventional (62) dimensions were chosen. One of the slides was covered with the anti-acne gel composition, the spreadability of which needed to be determined. The formulation was sandwiched between the second slide and the slide for a length of 6 cm along the slide when the second slide was positioned above the first slide. The anti-acne gel mixture between the two slides was traced uniformly to form a thin layer by placing 100 grammes of weight on the upper slide.

The extra anti-acne gel mixture that had adhered to the slides was scraped off after the weight was removed. The top slide's one end was attached to a string, on which a 20-gram force could be delivered 50 times with the aid of a straightforward pulley, while the lower slide was fixed to the apparatus's board. The amount of time needed for the upper slide to move the 6 cm distance and separate from the lower slide under the influence of weight was recorded.

Determination of pH

A digital pH metre was used to check the anti-acne gels' pH levels. The electrode was then dipped into the gel formulation until a consistent reading was obtained after one gramme of gel had been dissolved in 25 ml of distilled water. Also seen was frequent reading. Two copies of the pH measurements for each formulation were made.

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Drugcontent (Phenol content)

By measuring 1gm of gel in a 10 ml volumetric flask that had been diluted with methanol, the amount of drug was ascertained. 1 ml of the Folin-Ciocalteu reagent (previously diluted with distilled water 1:10 v/v) and 1 ml (7.5g/l) of sodium carbonate were combined with 3 ml of the stock solution. The mixture was vortexed for 15 seconds before being left to stand for 10 minutes to develop the colour. In order to determine the absorbance, a spectrophotometer was used at 765 nm.

***In vitro* anti-acne activity of marketed formulation and polyherbal gel**

Agar well-diffusion method was followed to determine theanti-acneactivityof marketed formulation and polyherbal gel (Bauer*et al.*, 1966). Nutrient agar (NA) plates were swabbed (sterile cotton swabs) with freshbroth culture of bacteria. Wells (6mmdiameter) were made in each of these platesusing sterile cork borer. 100mg/ml, 50mg/ml, 25mg/ ml solution wasprepared for polyherbal gel and 100µg/ml, 50µg/ml, 25µg/ ml wasprepared for marketed formulation respectively. About 100 µl of differentconcentrations of marketed formulation and polyherbal gel were added sterile micropipetteinto the wells and allowed to diffuse at room temperature for 2hrs.Control experiments comprising inoculums distilled water were set up. The plates were incubated at 37°C for 24 h forbacterial pathogens. Thediameter of the inhibition zone (mm) was measured and the activityindex was also calculated. Triplicates were maintained and theexperiment was repeated thrice, for each replicates the readingswere taken in three different fixed directions and the average valueswere recorded.

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Results & Discussion

The colour of all formulations was observed to be brownpossibly as a result of the brownish yellow hue of the mixed extracts. For the formulations F1 to F5 the transperarancy & consistency was appreciallble with zero sediments. But F6 reported to have sediments with thin and runny consistency. The washability of formulation from F1 to F5 was better but for F6 it retained minimal residue after rinsing. Extrudability must be measured in order to determine how easily topical treatments like ointments, lotions, and gels may be applied and removed.Over the course of a product's shelf life, its consistency may change. Product producers can track these changes and adjust formulas as necessary. This enables manufacturers to assess how well a packing material and its design work together. In this case the Extrudability ranged from 158±4 to 196±3 g. The next important parameter that was evaluated was pH. A decent topical medication should have a pH range of 4.2 to 6.5 that is suitable for the skin. Skin that is scaly will occur from overly alkaline gels. On the other hand, if the pH is too acidic, the skin will become irritated. The pH range observed in this case varied from 6.5±0.1 to 6.9±0.3. Furthe maximum drug content of 0.785 was observed in F4 formulation. The anti acne activity of F4 formulation was checked by well diffusion method using marketed formulation named Clintop gel as standard. In case of Clintop gel at 100µg/ml the zone of inhibition was recoreded as 16±0.57 mm while in case of polyherbal gel at 100mg/ml concentration the zone of inhibition for F4 was noted as 17±0.5mm. Thus, the formulation of gel F4 had a synergistic effect of all plant extracts were used to treat mild acne vulgaris.

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Table 2: Results of appearance and consistency

Formulation Code	Color	Transparency	Sediments	Consistency	Notes
F1	Brown	Transparent	None	Smooth and thick	No visible issues
F2	Brown	Transparent	None	Smooth and thick	No visible issues
F3	Brown	Transparent	None	Smooth and thick	No visible issues
F4	Brown	Transparent	None	Smooth and thick	No visible issues
F5	Brown	Transparent	None	Smooth and thick	No visible issues
F6	Brown	Cloudy	Sediments present	Thin and runny	Sediments settled at the bottom

Table 3: Results of Washability

Formulation Code	Residue after Rinsing	Skin Feel	Notes
F1	No residue	Clean and refreshed	No stickiness or film observed
F2	No residue	Clean and refreshed	No stickiness or film observed
F3	No residue	Clean and refreshed	No stickiness or film observed
F4	No residue	Clean and refreshed	No stickiness or film observed
F5	No residue	Clean and refreshed	No stickiness or film observed
F6	Minimal residue	Slightly tacky	Some residue left on the

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			skin

Table 4: Results of Extrudability

Formulation Code	Extrudability (g)
F1	158±4
F2	165±6
F3	176±8
F4	183±5
F5	189±4
F6	196±3

Determination of pH

Table 5: Results of pH

Formulation Code	pH
F1	6.8±0.2
F2	6.7±0.1
F3	6.9±0.3
F4	6.7±0.2
F5	6.5±0.1
F6	6.7±0.2

Table 6: Results of drug content

Formulation Code	Drug content
F1	0.582
F2	0.612
F3	0.615
F4	0.785
F5	0.675
F6	0.585

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Table 7: Anti-acne activity of marketed formulation and polyherbal gel (F4) against *Propionibacterium acnes*

S. No.	Formulation	Zone of inhibition (mm)		
		25µg/ml	**50 µg/ml**	**100µg/ml**
1.	Clintop gel	10±0.5	12±0.86	16±0.57
		25mg/ml	**50 mg/ml**	**100mg/ml**
2.	Polyherbal gel	9±0.86	12±0.74	17±0.5

Conclusion

It can be concluded that poly herbal gel for anti-acne treatment using extracts of *Basella alba*, *Boerhavia diffusa*, and *Kaempferia galanga* in an aqueous based Carbopol gel system was prepared successfully. Total Six formulations of the gel were prepared by varying the proportions of polymers and evaluated for their physicochemical properties, like pH, spreadability, viscosity, and microbial assay. The microbial assay of all the formulations demonstrated better inhibitory activity against *Propionibacterium acnes* stood competitive to the standard marketed formulation. It was concluded that the present research might hopefully bring advancement in the treatment of acnes using herbs as well as in developing poly herbal formulations for safe and effective management of diseases.Topical application of gels at pathological areas offers significant advantages over cream and ointment in terms of a faster release of a medication to the site of action. This investigation made it abundantly evident that all herbal components have unique chemical compositions and exhibit antibacterial action.

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