https://doi.org/10.48047/AFJBS.6.Si3.2024.1127-1135

African Journal of Biological Sciences

Development And Assessment Of Vigna Radiata And Aloe Vera – Based Herbal Gel For Acne Management"

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Article Info
Volume:6,Issue Si3,2024
Received:14April2024
Accepted: 11May2024
doi:10.48047/AFJBS.6.Si3.2024.1127-1135

Abstract:
This study presented the formulation and evaluation of an innovative herbal gel aimed at combating acne, utilizing Vigna Radiata (mung bean) extract and Aloe vera. Acne, a prevalent dermatological concern, demanded efficacious and safe interventions, particularly amid rising concerns over adverse effects associated with conventional treatments. Leveraging the synergistic potential of Vigna Radiata's antimicrobial properties and Aloe vera's anti-inflammatory and wound-healing attributes, a novel herbal gel was formulated. The gel was meticulously evaluated for various physicochemical attributes, including pH, viscosity, spreadability, and stability, ensuring its suitability for topical application. The results revealed promising outcomes, showcasing the herbal gel's potential as a safe and effective alternative for acne management. This study underscored the significance of harnessing natural ingredients in skincare formulations, offering a sustainable approach towards addressing dermatological concerns while minimizing adverse effects.

Keywords: Aloe barbadensis, Vigna radiata, Carbopol 940, polyherbal gel, acne

Introduction:

Acne vulgaris remained a widespread dermatological concern affecting individuals worldwide, often necessitating effective yet safe therapeutic interventions. Over the years, natural remedies had garnered attention for their potential in acne management, given their perceived efficacy and favorable safety profiles. Aloe vera and Vigna Radiata had emerged as promising candidates, attributed to their diverse pharmacological properties. Aloe vera, a succulent plant with a long history of medicinal use, had been extensively studied for its anti-inflammatory, antimicrobial, and wound-healing properties [1]. Its bioactive constituents, including polysaccharides, anthraquinones, and vitamins, exerted multifaceted effects that were pertinent to acne treatment [2]. Studies had demonstrated Aloe vera's ability to alleviate inflammation, inhibit bacterial proliferation, and promote skin regeneration, making it a valuable asset in skincare formulations [3]. Similarly, Vigna Radiata, commonly known as mung bean, had been recognized for its antimicrobial activity against various pathogens, including those implicated in acne pathogenesis [4]. Rich in bioactive compounds such as flavonoids, phenolic acids, and peptides, Vigna Radiata exhibited promising anti-inflammatory and antioxidant properties, which were instrumental in mitigating acnerelated inflammation and oxidative stress [5]. Past research endeavors had explored the individual

therapeutic potential of Aloe vera and Vigna Radiata in dermatological applications, including acne management [6][7]. However, there remained a gap in the literature regarding the formulation and evaluation of a polyherbal gel integrating these botanical extracts for enhanced efficacy and synergistic effects. Building upon the insights gleaned from previous studies, the current research addressed this gap by formulating and evaluating a novel polyherbal gel utilizing Aloe vera and Vigna Radiata extracts. By harnessing the complementary pharmacological properties of these botanicals, the study aimed to develop a potent anti-acne formulation capable of mitigating inflammation, inhibiting bacterial growth, and promoting skin healing. Through meticulous formulation optimization and comprehensive evaluation, the proposed polyherbal gel sought to offer a promising alternative for acne management, catering to the growing demand for safe and efficacious natural remedies in dermatology. The preparation of the polyherbal gel involved extracting bioactive compounds from Aloe vera and Vigna Radiata using suitable solvents such as ethanol or water. These extracts were then incorporated into a gel matrix, typically composed of natural or synthetic polymers such as carbomers or hydroxyethyl cellulose. Formulation optimization techniques, including concentration adjustment and compatibility testing, ensured the stability and efficacy of the gel. Finally, the formulated polyherbal gel underwent rigorous evaluation for physicochemical properties, antimicrobial activity, skin compatibility, and therapeutic efficacy, paving the way for its potential application in acne management.

Preparation of anti-acne polyherbal gel:

The preparation of a polyherbal gel incorporating Vigna radiata (mung bean) and Aloe vera involved several steps to ensure the effectiveness and stability of the final product. Firstly, the raw materials, including Vigna radiata seeds and Aloe vera gel, were collected and processed. Vigna radiata seeds were cleaned, washed, and dried to remove any impurities or contaminants. They were then ground into a fine powder using a grinder or mill. Aloe vera leaves were harvested, washed, and filtered to extract the gel. The gel was then processed to remove any aloin or latex components that may cause irritation. Next, the herbal extracts were prepared by extracting active constituents from Vigna radiata seeds and Aloe vera gel. Various extraction methods such as maceration, percolation, or Soxhlet extraction could be employed to obtain the desired phytochemicals from the plant materials. Solvents like water, ethanol, or a mixture of both could be used depending on the polarity of the target compounds.

Once the herbal extracts were obtained, they were standardized to ensure consistent potency and efficacy. Standardization involved quantifying the concentration of bioactive compounds such as flavonoids, phenolics, polysaccharides, and vitamins present in the extracts. Analytical techniques like high-performance liquid chromatography (HPLC) or spectrophotometry were commonly used for this purpose.

[2] After standardization, the polyherbal gel was formulated by blending the Vigna radiata and Aloe vera extracts with suitable excipients and additives. Excipients like carbomers, glycerin, propylene glycol, and preservatives were added to improve the rheological properties, stability, and shelf-life of the gel. The formulation was then homogenized using a high-speed mixer or homogenizer to ensure uniform distribution of the herbal extracts and excipients. Finally, the polyherbal gel underwent quality control tests to assess its physicochemical properties, microbial purity, and safety. Tests such as pH measurement, viscosity determination, microbial enumeration, and stability studies were conducted according to pharmacopoeial standards to ensure the product met regulatory requirement.

Materials and Methods:

Materials:

Aloe barbadensis was collected from the medicinal garden, and the seeds of Vigna radiata were procured from a local market and authenticated by Karmaveer Bhaurao Patil Mahavidyalaya, Pandharpur.

Methods:

Extraction of Vigna radiata: The seeds of Vigna radiata were collected and milled into fine particles. About 100g of the crushed Vigna radiata powder was extracted using ethanol as a solvent. The process continued until the solvent turned clear.
The extract was evaporated to dryness [11].

Collection of Aloe barbadensis Gel: Fresh leaves of Aloe barbadensis were collected. The outer thick epidermis of the leaf was selectively removed, and the inner gel-like pulp in the center of the leaf was separated, minced, and homogenized in a mortar and pestle. It was filtered using filter paper to obtain a clear liquid [12].

Evaluation of the Vigna radiata Extract Characteristics: The ethanolic extract of Vigna radiata was evaluated for its physical state, color, and odor.

Phytochemical Investigation of the Extract: The alcoholic extract of Vigna radiata was screened qualitatively for the presence of various phytoconstituents, such as flavonoids, proteins, amino acids, phenol, and organic acid.

Determination of Anti-Infective Activity: The anti-acne activity of the extract against infectious agents was performed using standard cultures of Staphylococcus aureus and Escherichia coli.

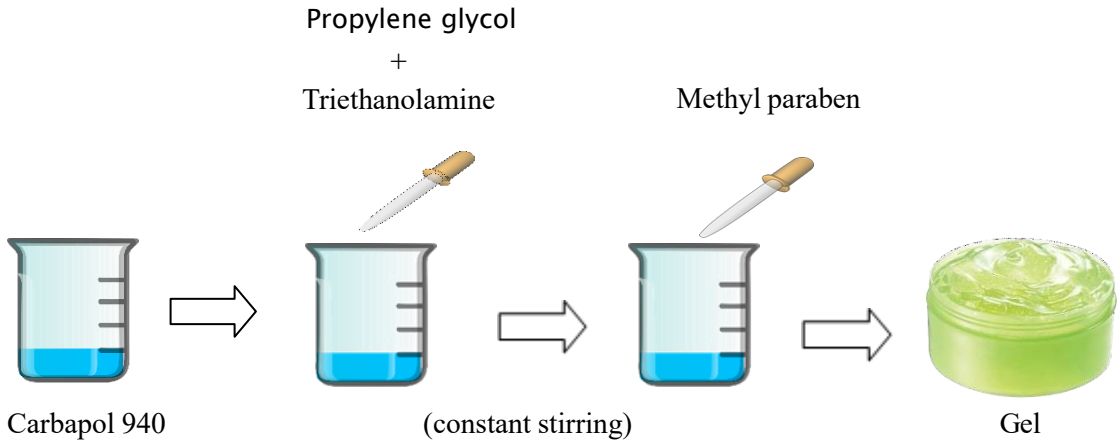
Results and Discussion:

Optimization of Gelling Agent:

A gel is usually made up of two components: a hydrophilic polymer and water, alcohol, or another solvent (such as propylene glycol). The hydrophilic polymer serves as a gelling agent in the majority of gels, which employ water. There are several distinct types of gelling agents that can be used. With respect to the amount of gelling agent utilized, the main property is the viscosity they offer. Those that produce a harder gel, however, frequently make it more brittle and prone to collapsing. There are certain incompatibilities as well, with some working better at specific pH levels than others. The gelling agent and the solubilizer are crucial components in the formulation of a gel. A gel can be clear, translucent, or opaque depending on the excipients employed. Choosing a proper gelling agent and maintaining a drug's solubilized state are challenging aspects of the formulation.

Formulation of Gel:

The process involved optimizing different concentrations of Carbopol 940, including 1, 1.5, and 2%, to obtain the gel with the desired physical characteristics. The Carbopol gel with a 2% concentration (G3) showed good physicochemical properties for incorporating ethanolic extracts of Vigna radiata and Aloe barbadensis. Table no. 1 presented the constituents of each formula.



Formulation of Carbopol gel.

Table No. 1

Ingredients	G1	G2	G3
Carbopol 940	1%	1.5%	2%
Propylene glycol	5 mL	5 mL	5 mL
Propyl paraben	0.30 g	0.30 g	0.30 g
Triethanolamine	5 mL	5 mL	5 mL
Water	q. s	q. s	q. s

Formulation of Polyherbal Gel Containing *Vigna radiata* and *Aloe barbadensis:*

Plants were regarded as an important source of potentially beneficial components for the creation of novel therapeutic medicines because the majority of them are harmless and have few or no side effects. Comparing topical gels to cream or ointment application, gels offered tremendous advantages in terms of a faster release of the medicine directly to the site of action. The topical administration of medications was frequently carried out using gels. This dosage form might include extracts of plants and herbs with particular therapeutic qualities as active ingredients to provide additional advantages. The polyherbal gel containing Vigna radiata and Aloe barbadensis was incorporated into the optimized 2% Carbopol gel base. Different concentrations of ethanolic extract of Vigna radiata, including 1, 1.5, and 2%, were also incorporated into the gel base. The Aloe barbadensis concentration was kept constant [5 mL] in all the gel base. The formulations of the designed polyherbal gel were presented in table No. 2.

Formulation of polyherbal gel.

Table No. 2

Ingredients	F1	F2	F3

Vigna radiata extract	1%	1.5%	2%
Aloe barbendensis gel	5 ml	5 ml	5 ml
Carbopol	2%	2 %	2 %
Propylene glycol	5 ml	5 ml	5 ml
Propylene paraben	0.30 gm	0.30 gm	0.30 gm

Evaluation of Polyherbal Gel Physical Appearance

The formulated gel was checked visually for color, appearance, and homogeneity; Physical appearance of the formulated gel:-

Characteristics	F1	F2	F3
Physical appearance	Transparent gel	Transparent gel	Transparent gel
Color	Pale yellow	Pale yellow	Pale yellow
Homogeneity	Absence of aggregates	Slight aggregates	Absence of aggregates

pH Determination:

A good topical preparation should have a pH that is acceptable for the skin, ranging from 4.2 to 6.5. Gels that were too alkaline would result in scaly skin. On the other hand, if the pH was too acidic, it would irritate the skin. The pH of the formulation was 5.3–6.0. The pH of the prepared gel showed its compatibility with the skin. Even though the ideal pH ranged below 5.0, the addition of stabilizers contributed to this pH range, making it suitable for topical application and penetration [13].

Determination of Viscosity:

Rheological characteristics of gels varied and showed reversible deformation, similar to that experienced by elastic materials, rather than flowing at low shear stresses. They flowed like liquids when a specific shear stress was exceeded, which was known as the yield value or yield stress. In general, the consistency of gel compositions was reflected in their viscosity. Non-Newtonian flow (shear thinning) showed how the viscosity of gels reduced with increasing shear rate; this behavior was desired because of its low flow resistance when used under high shear conditions. The rheological property helped in determining consistency and influenced the diffusion rate of a drug from a gel. Additionally, this low viscosity was an indication of the viscoelastic behavior of the gel upon applied stress, which made it easier to flow from the container to the applying area and suck back to the container upon the release of stress [14].

Measurement of pH, viscosity, and spreadability.

Formulation Code	pH	Viscosity (cps)	Spreadability (g cm/s)
F1	5.3	1378	20.22
F2	5.9	1345	22.35
F3	5.1	1477	23.13

Table N0. 03

Spreadability:

Manufactured gels had to have good spreadability and satisfy the ideal quality in topical application since the spreadability of the gel aided in the uniform application of the gel to the skin. Additionally, it was thought that this was a key element in patient adherence to therapy. Spreadability denoted the area and the extent to which a gel readily spread upon topical application [15]. The spreadability of the different gel formulations was studied. The formulation F3 produced better spreadability than the other formulations. The results of the three physical parameters were presented in Table no.3. To have good permeation across the skin, the gel should have ideal properties and stability over a long period. From the results obtained for the physical parameters, such as pH, viscosity, and spreadability, it could be seen that the formulation F3 was ideal; thus, it was chosen for further characterization, such as texture analysis.

Stability studies :

Table No. 04

	STORAGE CONDITION		
	7 days	15 days	30 days
Appearance			
	Semisolid	Semisolid	Semisolid
F2	Semisolid	Semisolid	Semisolid
F3	Semisolid	Semisolid	Semisolid
Colour			
F1	Yellow	Yellow	Pale Yellow
F2	Yellow	Yellow	Yellow
F3	Yellow	Yellow	Yellow
Odour			
F1	Characteristic	Characteristic	Characteristic
F2	Characteristic	Characteristic	Bad smell
F3	Characteristic	Characteristic	Characteristic

Stability studies of different formulations were carried out at different time periods. Samples were withdrawn at intervals of 7, 15, and 30 days, and the results were tabulated in Table No.04. During the study period, all the formulations were found to be homogeneous and free from microbial growth. There was a slight change of color in the F1 formulation, and the F2 formulation developed a bad smell when stored. The pH of the gel also changed in both the F1 and F2 formulations.

Antimicrobial activity testing by the cup plate method:-The antimicrobial activity testing was performed by measuring and comparing the diameter of zones of inhibition (in mm). The zone of

inhibition was defined as the clear region around the well that contained an antimicrobial agent. It was known that the larger the zone of inhibition, the more potent the antimicrobial agent. The formulated polyherbal gel (F3) was observed for its antimicrobial property towards organisms such as Staphylococcus aureus and Escherichia coli and was also compared with the standard, Gentamicin 10-mcg, which had a 21-23 mm zone of inhibition against Staphylococcus aureus and Escherichia coli. From the results, it was observed that the formulated gel showed a good zone of inhibition, but it was less than the standard. The zones of inhibition of the formulated gel were mentioned in Table No.05.

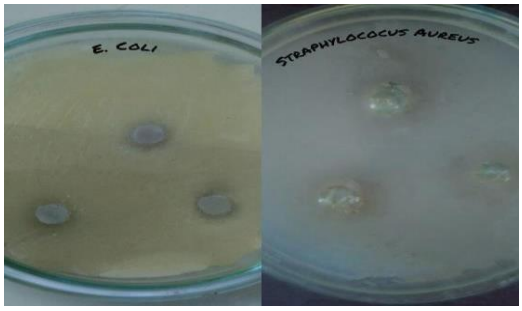


Fig. Antibacterial activity of gel against *Styphylococcus Aureous* and *E. Coli.*

Zone inhibition against bacteria's:

	Organism							
	Staphylococcus aureus			Mean(mm)	*Escherchia coli*			Mean(mm)
	1	2	3		1	2	3	
Polyherbal Gel F3	10.2	11.4	12.2	11.2	11.2	11.5	12.3	11.6
Gentamicin	21 – 23 mm							

Table No.05

Conclusion:

The polyherbal gel has been successfully formulated using *Vigna Radiata* and *Aloe barbandensis* . Polyherbal gel has evaluatrd for pH,viscosity,spreadability and antimicrobial activity. Gel showed ph about 5.7 which is acceptable to avoid the risk of skin irritation. Gel showed good spreadability which is about 23.77gm.cm/sec.Gel showed about 1427cps good viscosity. The formulation should acceptable results. The bacterial study has shown 11.2mm zone of inhibition verses Gentamicin (21-23mm) zone of inhibition. The anti-bacterial study revealed the antibacterial potential of polyherbal gel. Further studies to characterize the pharmacokinetics of the polyherbal gel and to establish its safety, stability, and anti-acne activity will be investigated using various new formulations at varied strengths and dosage forms, as well as with different plant extracts. Further studies, such as in-vitro antiacne tests, could explore its efficacy and safety profile for in vivo application.

Compliance with ethical standards

Conflict of interest: The authors declare that they have no conflict of interest.

Human and animal rights: This article does not contain any studies with human and animal subjects performed by any of the authors.

REFERENCES:

1. Surjushe, Amar, et al. "Aloe vera: a short review." Indian Journal of Dermatology 53.4 (2008): 163.
2. Radha, Maharjan Hiran, and Surya Kant Kalauni. "Chemical composition of Aloe vera plant parts and its potential applications." International Journal of Chemical Studies 2.5 (2014): 45-48.
3. Foster, Meika, and Anthony Hunter. "Theeffect of aloe vera gel/mild soap versus mild soap alone in preventing skin reactions in patients undergoing radiation therapy." Oncology Nursing Forum. Vol. 29. No. Oncology Nursing Society,2002.
4. Mohamadi, Narges, et al. "Antibacterialactivity of some plants extracts against multi- drug resistant Escherichia coli strains isolated from patients in hospital in Kermanshah, Iran." Journal of Herbal Medicine 2.4 (2015): 182-185.
5. Kim, Jung Eun, et al. "In vitro and in vivo anti-inflammatory effect of mung bean (Vigna radiata L.)." Bioscience, biotechnology, and biochemistry 68.12 (2004): 1199-1205.
6. Hajhashemi, Valiollah, et al. "Anti- inflammatory and wound healing activities of Aloe littoralis in rats." Research Journal of Pharmacognosy 1.1 (2014): 43-49.
7. Hwang, Jin-Woo, et al. "Evaluation of the antioxidant, anti-inflammatory, and anticancer activities of Aloe secundiflora." Journal of Ethnopharmacology 106.2 (2006): 242-248.
8. Pandey, A., Bigoniya, P., Raj, V., & Patel, K.K. (2012). Formulation and evaluation of polyherbal gel for anti- acne activity. International Journal of PharmaceuticalSciences and Drug Research, 4(2), 141-144.
9. Gupta, A. K., Pawar, V. K., & Singh, A.(2014). Formulation and evaluation of herbal gel containing extract of Abelmoschus esculentus and Aloe vera for wound healing activity. International Journal of Research in Ayurveda and Pharmacy, 5(4), 457-461.
10. Prajakta Khule, Vrunal More, Manojkumar Nitalikar, Mithun Maniyar. Effect of Penetration enhancers on Topical Antifungal gel. Research Journal of Pharmacy and Technology 2023; 16(9):4431-5.
11. Bendgude RD, Maniyar MG, et al, 2012. Anthelmintic Activity of Leaves of Mimosa Pudica, Int. J. of Institutional Pharmacy and Life Sci. 2(1), 120-125.
12. Kang M.C., Kim S.Y., Kim Y.T., Kim E.A., Lee S.H., Ko S.C., Wijesinghe W.A., Samarakoon K.W., Kim Y.S., Cho J.H., et al. Invitro and in vivo antioxidant activities of polysaccharide purified from aloe vera (Aloe barbadensis) gel. Carbohydr. Polym. 2014;99:365-371.doi: 10.1016/j.carbpol.2013.07.091. [PubMed] [Cross Ref] [Google Scholar]
13. Bayan M.F., Marji S.M., Salem M.S., Begum M.Y., Chidambaram K.,Chandrasekaran B. Development of polymeric-based formulation as potential smart colonic drug delivery system. Polymers. 2022;14:3697.doi: 10.3390/polym14173697. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
14. Obaidat R.M., Tashtoush B.M., Bayan M.F.,TAl Bustami R., Alnaief M. Drying using supercritical fluid technology as a potential method for preparation of chitosan aerogel microparticles. AAPS PharmSciTech. 2015;16:1235-1244. doi: 10.1208/s12249-015-0312-2. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

15. Ilango K.B., Gowthaman S., Seramaan K.I.,Chidambaram K., Bayan M.F., Rahamathulla M., Balakumar C. Mucilage of Coccinia grandis as an efficient natural polymer-based pharmaceutical excipient. Polymers.