



## Research Article

### FORMULATION AND ANTIMICROBIAL EVALUATION OF A NOVEL ANTI-ACNE HERBAL HYDROGEL

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<p><b>Article info</b></p> <p><b>Article History:</b> Received: 01-11-2022 Revised: 18-11-2022 Accepted: 04-12-2022</p> <p><b>KEYWORDS:</b> Acne vulgaris, Propionibacterium acne, Yuvanapidika.</p>	<p><b>ABSTRACT</b></p> <p><b>Objective:</b> The present study evaluates anti-microbial effect of hydrogel formulated with the extracts of some indigenous drugs against <i>Propionibacterium acne</i>.</p> <p><b>Material and Method:</b> Procured <i>Manjishtha</i> (<i>Rubia Cordifolia</i> L.), <i>Shalmali</i> (<i>Salmalia malabarica</i> (DC. Schott &amp; Endl) Schott &amp; Endl.), <i>Daruharidra</i> (<i>Berberis aristate</i> DC), <i>Aloe vera</i> (<i>Aloe barbadensis</i> Miller), <i>Yashthimadhu</i> (<i>Glycyrrhiza glabra</i> L). Extracts of all drugs except Aloe vera were collected by hydroalcoholic extraction using the Soxhlet apparatus. Aqueous extract of Aloe vera was collected by drying method. Two types of hydrogels were prepared with the extracts of these drugs, one with 5% extract and the other with 10% extract. <i>Propionibacterium acne</i> strains were collected from CSIR-Imtech Chandigarh. Culturing of bacteria was done by using nutrient broth. Nutrient agar was used for preparing the culture media. The antibacterial efficacy of the hydrogels was evaluated by comparing them with standard gentamycin. <b>Result:</b> The prepared hydrogel showed an anti-bacterial effect, but it is comparatively less when compared with the standard gentamycin. <b>Conclusion:</b> The prepared gel has anti-microbial activity. 10% hydrogel showed better results than 5% hydrogel.</p>
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### INTRODUCTION

Acne vulgaris is a long-term condition of the skin that occurs when dead skin cells and oil from the skin clog the hair follicles. It is a chronic inflammatory disease affecting the pilosebaceous unit (comprising hair follicle, hair shaft, and sebaceous gland) and is one of the most common dermatological conditions worldwide. In a study of "Global burden of disease," it is revealed that acne was the 8<sup>th</sup> most commonly prevalent disease worldwide<sup>[1]</sup>. It mainly affects the face, upper part of the chest, and back and it is very common in adolescence<sup>[2]</sup>. Particular symptoms of this condition include blackheads, whiteheads, pimples, oily skin, and scarring also<sup>[3]</sup>.

It always causes a negative psychological impact on human life<sup>[4]</sup>. In modern medicine, antibiotics are used internally and as local applications also for curing acne<sup>[5]</sup>. However, excess use of antibiotics causes antibiotic resistance<sup>[6]</sup>. In one study, covering 10 years in the U.K. it was noted, antibiotic resistance is found in more than 50% of patients who had acne and were treated with antibiotics, with most patients suffering multiple different resistant strains on different parts of their bodies<sup>[7]</sup>. In Ayurveda, the features of acne vulgaris can be correlated with *Yuvana pidika* or *Mukhadushika*. Because of the antibiotic resistance, side effects, and high cost of treatment, it is always good to evaluate the efficacy of herbal drugs for curing acne. There are a lot of herbal drugs mentioned in Ayurveda for curing *Yuvana pidika*. The main four causes of acne vulgaris are increased sebum production influenced by androgen, excessive deposition of the protein keratin leading to comedo formation, bacterial growth, and inflammation. *P. acne* is a tiny microbe that lives in the oily region of the skin's pores. The bacteria can aggravate the immune response which causes red, swollen bumps to develop

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on the skin. So, the drugs having the property of anti-androgenic, anti-bacterial, anti-inflammatory, and anti-oxidant will be definitely good for curing acne. In this study, five herbs were selected i.e., *Manjishtha* (*Rubia Cordifolia*), *Shalmali* (*Salmalia malabarica*), *Daruharidra* (*Berberis aristate*), *Aloe vera* (*Aloe barbadensis*), *Yashthimadhu* (*Glycyrrhiza glabra*) for making hydrogel. In Ayurveda, applying for medicine externally is termed *Lepa Kalpana*. In *Lepa Kalpana* herbal drugs are ground with any suitable liquid material and made into a paste and applied externally<sup>[8]</sup>. Nowadays it is difficult to use *Lepa* in its actual form because of smell, greasiness, and lack of time. Because of these reasons, the present era demands potent, easy, and fast formulation. So, hydrogel formulation with the extracts of these five drugs will be a solution to these problems. Gels are more preferable than other dosage forms like cream and ointment because of their fast drug release,

excellent appearance, ease of manufacturing, and considerable stability<sup>[9]</sup>. Gels provide better absorption characteristics hence increasing the bioavailability of the drugs. <sup>[10]</sup>

**MATERIAL AND METHODS**

**Formulation of Hydrogel**

*Manjishtha*, *Daruharidra*, *Yashthimadhu* were procured from the local market of Haridwar. *Aloe vera* and thorns of *Shalmali* were collected from the herbal garden of Rishikul Campus, Haridwar. All drugs were identified in the Department of Dravya Guna Vijnana, All the drugs except *Aloe vera* were grinded and made into coarse powder form. Hydroalcoholic extraction was performed for all four drugs using ethanol and water in a ratio of 9:1 using Soxhlet extraction. Defatting with n-Hexane was performed before hydroalcoholic extraction for removing fat contents. The yield of all extracts is given below.

**Table 1: Yield of all Extracts**

S. No	Name of the Drug	Amount Taken	Yield	Percentage
1	Thorns of <i>Shalmali</i>	40g	4.055g	10.13%
2	<i>Manjishtha</i>	60g	9.11 g	15.19%
3	<i>Daruharidra</i>	58g	5.33g	9.19%
4	<i>Yashthimadhu</i>	61g	14.78 g	24.22%



**Thorns of *Shalmali***



***Manjishtha***



***Daruharidra***



***Yashthimadhu***



***Aloe vera***

Aqueous extract of aloe vera pulp was collected by adding 30ml distilled water to the pulp of aloe vera and grinded with a mixer grinder and dried by using in a microwave oven by adjusting the temperature at 40°C for 24 hours. The amount of pulp taken for extraction was 348gm and the extract collected was 4.07gm. So, the yield of aloe vera extract was 1.16%.

Two types of hydrogels were prepared, one with 5% extract and another with 10% extract. In 5% hydrogel, 1% extract of each drug and for 10% hydrogel 2% of each drug were taken for formulating the gel. After

lots of trials for formulating hydrogel, the following quantities were selected for the formulation of hydrogel of desired consistency and pH.

**Table 2: Formulation of Hydrogel**

S. No.	Name	Quantity
1	Carbopol 940	1gm
2	Distilled water	98ml
3	Methyl paraben	150mg
4	Propyl paraben	50mg
5	Benzyl alcohol	1gm
6	Extract of each drug	1g each (5%), 2g each (10%)
7	Triethanolamine	8 drops

In a 200ml beaker, 98ml distilled water was taken and added with 1gm Carbopol 940 and heated at 40°C in a magnetic stirrer until it becomes viscous. Then all preservatives were added. For making 5% gel, 5g gel base was removed and 5g extract was added and stirred well. For making 10% gel, 10gm gel base was removed and 10gm extract was added to it. After checking the pH, triethanolamine was added for maintaining the pH of 6.5.<sup>[11]</sup>

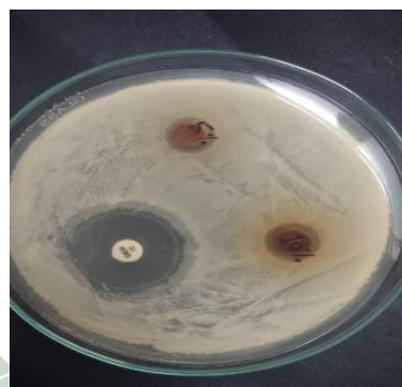
#### Anti-microbial Study

The Well diffusion method was adapted for analysing anti-microbial property. *P. acne* bacterial strain was purchased from Imtech- Chandigarh. The nutrient broth was used for culturing the bacteria. 1.3g nutrient broth was dissolved in 100 ml distilled water and autoclaved at 121°C for 20 minutes.

After that it was incubated at 37°C for 24 hours. Agar was prepared by mixing 2.28gm nutrient agar in 60ml distilled water and autoclaving was done. The agar was poured into 2 Petri plates and left for solidification. The culture was spread on the sterile nutrient agar plates with the help of a sterile swab stick. Three wells of approximately 8mm in diameter were bored on the surface of the agar medium using a sterile cork borer. Then the samples were introduced into the well. Both 5% and 10% gel were taken in a quantity of 10 mcg and dissolved in 1ml of distilled water. Gentamycin (10mcg/ml) was used as the standard. Then the plates were incubated at a temperature of 37°C for 16 hours.

#### RESULT

The zone of inhibition for 5% gel was 7mm and 10% gel was 10mm and for standard it was 16mm. The activity index of 5% gel was 0.48 and for 10 % gel was 0.62. The result indicated that the gel is susceptible against *P. acne*.



#### DISCUSSION

Acne is a dermatological condition affecting almost every individual at least once in their lifetime. It affects commonly during the teenage period and causes a negative psychological impact on the life of individuals. Oral antibiotics and topical medication are used for treating acne in modern medicine. But these treatments are not satisfactory because of antibiotic resistance and side effects. As the key factors for the causes of acne are androgen-mediated stimulation of sebaceous gland activity, follicular hyperkeratinisation, colonization of bacteria, and inflammation so, for curing acne herbal drugs having the potency of anti-bacterial, anti-inflammatory, anti-androgenic, and anti-oxidant are useful. The hydrogel was prepared with the hydroalcoholic extracts of *Rubia cordifolia*, *Salmalia malbarica*, *Berberis aristata*, *Glycyrrhiza glabra* and aqueous extract of *Aloe barbadensis*. Defatting was performed for removing the fatty contents from the ingredients, as the fatty contents do not dissolve in hydrogel. Two formulations were prepared, one with 5% extract and other with 10 % extract. Both the hydrogels showed anti-bacterial activity. The hydrogel was susceptible to *P. acne* in a dosage of 10mcg diluted in 1 ml of distilled water. 10% hydrogel showed more susceptibility than 5% hydrogel. So, on increasing the concentration of extract, result was more significant. The diluted hydrogel (diluted in distilled water) was used for the antimicrobial study, so better results can be expected,

if undiluted hydrogel will be applied directly on the skin.

## CONCLUSION

Acne causes significant morbidity that is associated with permanent scarring and psychological disturbances such as lack of confidence, depression, and anxiety. Nowadays, anti-biotic treatment for acne is not appreciable because of antibiotic resistance. Herbal formulations will be a solution to cure this problem. The hydrogel prepared with the above-mentioned ingredients has been proven to be effective against *P. acne*, and has shown anti-inflammatory, antioxidant, and anti-oxidant properties also in various studies. Therefore, the hydrogel can be expected to be effective against acne in all aspects.

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### Cite this article as:

Lekshmy M, Yadevendra Yadav, Deepak N. Kapoor, Shuchi Mitra. Formulation and Antimicrobial Evaluation of a Novel Anti-Acne Herbal Hydrogel. *International Journal of Ayurveda and Pharma Research*. 2022;10(11):23-26.

<https://doi.org/10.47070/ijapr.v10i11.2589>

**Source of support: Nil, Conflict of interest: None Declared**

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