WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.453
Volume 14, Issue 10, 1494-1505. Research Article ISSN 2277–7105

AIM: PREPARATION AND EVALUATION OF SEMI-SYNTHETIC ANTI-ACNE GEL

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Article Received on
21 March 2025,

Revised on 11 April 2025,
Accepted on 01 May 2025

DOI: 10.20959/wjpr202510-36833

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1. ABSTRACT

Acne is most common skin problem mainly occurs in teenagers during adolescent stage. It can be a very unpleasant appearance of skin due to acne which primarily looks like red patches filled with puss due to inflammation caused by bacteria. The main causative bacteria for acne is Propionibacterium and the acne is well known as acne vulgaris.[1] There are various synthetic pharmaceutical products are present in market to treat this problem but the continuous use of chemical based formulation can cause skin damage over a period of time. To avoid any other skin problems, modern generation is turning towards using herbal based pharmaceuticals which are highly effective as well as gives very less side effects. This research is aimed to formulate semi synthetic anti acne gel in combination with tomato extract[2],[3], Aloe vera and honey which gives significant result in acne treatment. This gel formulated using different concentrations of aloe vera, tomato extract and honey in batches F1, F2 and F3. The gel phase of formulation is prepared by using Carbopol-940 as gelling agent, Triethanolamine as pH stabilizer, Glycerol as humectant and EDTA as a stabilizer.[4] The evaluation test like Stability, Spreadability, Washability, pH, Antimicrobial activity are studied, the test results shows an impactful gel formulation which could be a better alternative for treatment of acne. The prepared gel is stored under normal room temperature and shown positive results.[6]

2. KEYWORDS: Herbal gel, Acne vulgaris, Tomato, Aloe vera, Honey.

3. INTRODUCTION

Over a period of time, with development of man with changing lifestyle has enhanced the usage and necessity of cosmetics as a beautifying agent. As the developing market demand of herbal cosmetics has increased significantly there are various herbal products are present in market. The herbal product is cosmetic preparation containing two or three herbal active ingredients which acts as medicine in treatment of various skin conditions. Plants are renewable sources and a healthy lifestyle is a demand of customers because of increasing awareness and environmental protection. The used parts of plant possesses anti-inflammatory activity, antioxidant property which enhances its overall effect on skin. The gel is semisolid aqueous preparation which is readily absorbable in skin. It is made up of gelling agents and herbal ingredients which provides a soothing effect to the skin. This gel is herbal formulation which can be used to treat acne.[1], [6]

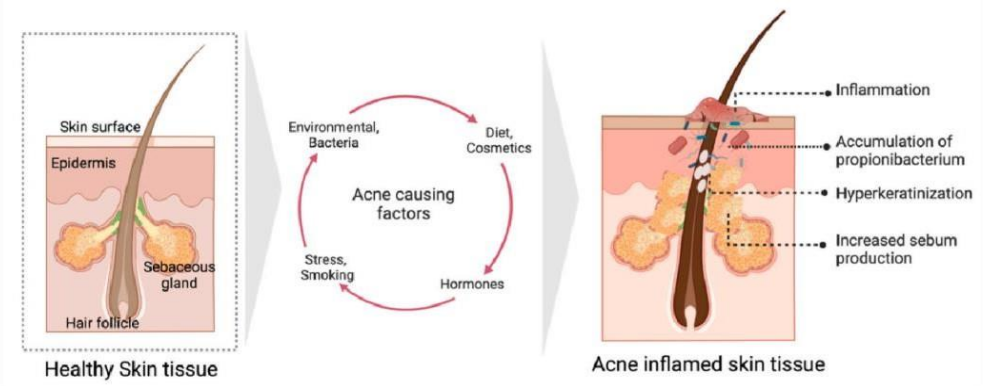

Fig. 1. Schematic illustration of healthy/normal skin tissue vs acne inflamed skin tissue, various factors (environmental, bacterial, diet, stress, smoking and relevant hormonal imbalance among others) contributing to the formation and development of acne.

Fig. 1: Schematic illustration of healthy skin vs inflamed skin.[1]

Acne Vulgaris

Acne Vulgaris is a common, long-lasting inflammatory ailment of the polysebaceous follicles found worldwide. While acne is not life-threatening, its severity can lead to scarring, irritation, and notable psychological impacts, such as depression. This research encompasses various factors contributing to acne and outlines their treatment options. It also discusses current medications and new investigational dosage forms along with information on clinical phases.

Pathophysiology: Involves four primary factors[6]

- Enhanced sebum product.
- Hyper keratinization of polysebaceous follicles.

- Hyper proliferation of Propionibacterium acnes.
- Inflammation.
- Identification of inflammatory (papule, pustule, bump, excrescence) and non- seditious (pustules, papules) lesions is vital for opinion.

Due to all above factors the acne formation takes place which may lead to painful lesions which causes sufferable scars on the skin, there are different types of acne as follows,

Types of Acne

A) Non-inflammatory Acne[6]

Blackheads Open comedones with a dark appearance. Papules Closed comedones with a white appearance.

B) Inflammatory Acne[6]

1. Papules Small, red, and inflamed bumps.
2. Pustules Red lesions with pus at the center.
3. Bumps Large, painful bumps under the skin.
4. Excrescencies Large pus- filled lesions that can lead to scarring.

-Factors Contributing to Acne Pathogenesis

- Genetics, environmental factors (pollution, humidity), diet, hormonal changes, stress, and comedogenic cosmetics.
- Hormones, particularly androgens, play a part in acne development.[1], [6]

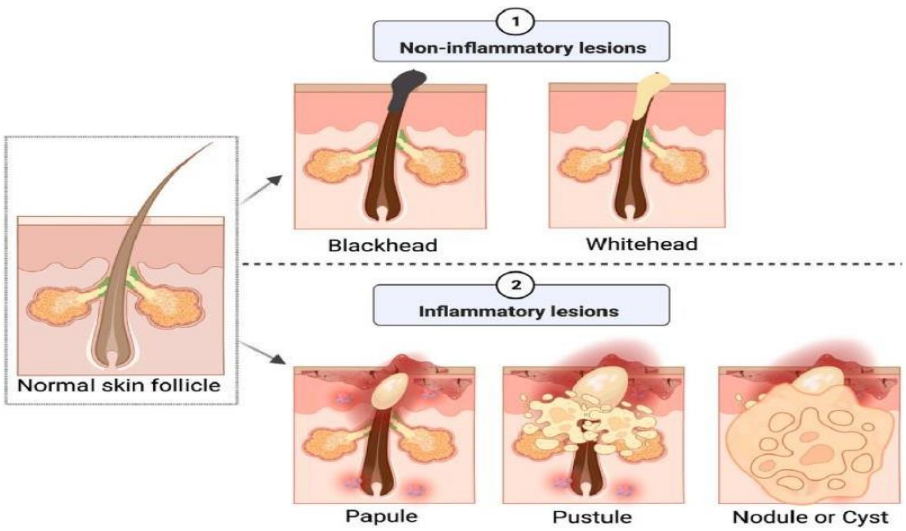

Fig. 2. Schematic illustration of major distinguishing of the two types of lesions (non-inflammatory, inflammatory) and their pathogenies.

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Fig. 2 Types of acne.[1]

This Research mainly focuses on formulating Herbal anti-inflammatory Anti acne gel which can be used to treat acne with lesser side effects.

The formulation contains herbs such as Tomato extract, Aloe vera extract and honey as active ingredients which are rich in various vitamins, phytoconstituents like phenolic acid, Barbadin, lycopene, antioxidants, etc. with a rational amount of all this ingredients in gel base gives a perfect herbal gel with anti-acne activity.

A. Herbal ingredients

Solanum lycopersicum belongs to family Solanaceae, which is rich lot of multivitamins such as, Vit-A, Vit-C, Vit-E, phytosterols, folic acid and the primary antioxidant named as lycopene which gives anti acne treatment by exfoliating dead skin over an acne scar. As the vegetable has versatile effects on skin and is affordable marks its high demand in cosmetic formulations.[3] Folic acid helps in exfoliation of homocysteine (Amino Acid). For normal functioning of muscles phosphorus, Magnesium, potassium and iron are present in tomato. Tomato (Solanum lycopersicum) consisting of lycopene has sunscreen efficacy which can provide ultraviolet (UV) irradiation in sunlight and protect skin from UV B induced photo-damage.[2],[7]

Aloe vera is known as *Aloe barbadensis.* Aloe is mucilaginous, colorless part of aloe leaf which is spiny, fleshy and extracted from 20cm to 30cm leaf. It contains various phytoconstituents which are minerals, fat-soluble and water-soluble vitamins, polysaccharides, organic acids, enzymes and phenolic compounds. It also contains amino acids, vitamins, sterols and lipids. The gel is primarily abstracted from leaves of aloe vera.[2] The Barbadin is a main phytoconstituents which provides antimicrobial as well as moisturizing effect to the skin. The antioxidants n aloe vera proves skin firmness and hydrates it. The vitamins like Vit-C, Vit-A, beta Carotene are present, due to its soothing and hydrating nature various pharmaceutical products are prepared e.g. Soap, Gel, creams and moisturizing lotions.[8]

Honey is a collection of nectar and it contains sugar up to 75-79%, water 20%, proteins, minerals, vitamins and antioxidants and the natural occurrence of hydrogen peroxide enzyme (H2O2). And the presence of methoxyglyoxal, which may contribute to the anti-microbial activity of the honey, the varied presence of various phytoconstituents of honey contributes to the soothing activity to the skin in cosmetic formulations.[10] Hone has low level of non-

cytotoxic effect, and it has disinfective activity, honey has low pH, high osmotic concentration and its viscous characteristics which gives preventive action towards microorganism's growth.[9]

B. Excipients

By using all above herbal ingredients, a gel is prepared which is non-greasy, washable, and readily absorbable in the skin. The excipients used in this formulation are, Carbopol-934, Triethanolamine, Sodium Benzoate, Benzoyl peroxide, EDTA, Water, Fragrance. With appropriate blending of all this excipients in a magnetic stirrer with 50rpm Speed gives a uniform formulation of gel.

1. Carbopol-934

Carbopol used in this formulation is a gelling agent which is bioadhesive material, stabilizing agent. It gives a proper gel texture to the formulation,[11]

2. Triethanolamine

It is used as a pH stabilizer in the formulation,[11]

3. Sodium Benzoate & Benzoyl Alcohol

The mixture of this two preservatives provide stability to the herbal gel, it increases its shelf like.

4. EDTA

It is used to stabilize the gel formulation,[11]

5. Water

It is a solvent used for the preparation of gel.[12]

Formulation Table

Table 1: Composition Of Prepared Herbal Gel.

Ingredients	F1	F2	F3
Tomato	2gm	2.5gm	3gm
Aloe Vera	2ml	2.5ml	2.5ml
Honey	1.5ml	2ml	2.5ml
Carbopol-934	0.2gm	2gm	2gm
Triethanolamine	0.01%	0.01%	0.01%
Sodium Benzoate	0.01%	0.01%	0.01%
Benzoyl Alcohol	0.01%	0.01%	0.01%
EDTA	0.01%	0.01%	0.01%
Water	Qs.	Qs.	Qs.

5. MATERIALS AND METHODS

5.1 Collection and Authentification of raw materials[7], [8], [9]

Tomato is selected for this formulation by considering its various phytochemical properties, from which lycopene is the main phytoconstituents which gives antioxidant property. The aloe vera used for this formulation as it provides soothing effect to the skin. And honey is mainly used for its anti- microbial activities.[9] The crude is obtained from marketed Powder of tomato, raw aloe vera is collected from leaves of aloe vera plant and Dabur honey is used which is pure.

The Authentification of the tomato powder is done in Dayanand college of Arts and sciences, Solapur, Botany department. Aloe vera is tested for crude drug activity in college laboratory.

5.2 Pretreatment of raw materials

The key ingredients were pretreated before formulating gel. The aloe vera is extracted from the leaves of plant. The raw tomato powder was extracted in the beaker adding appropriate amount of water in the powder and kept on water bath for 20min at 80 degree temperature to avoid degradation of essential phytoconstituents, the boiled powder extract later cooled and the tomato powder extract is filtered and stored in the air tight container. Al the extracted raw ingredients are stored properly.

5.3 Preparation of gel[4]

The standard method of gel formulation is used to prepare herbal gel. The gel was prepared using carbopol-934, Triethanolamine, EDTA, Sodium Benzoate, Benzoyl Alcohol, and distilled Water in a sufficient quantity for making a blank gel of 50gm. The water is divided in two parts, in which one part is used to dissolve extract of herbs and the other part is used to dissolve excipients. Both prepared solutions are then mixed together and triethanolamine is mixed dropwise to maintain pH. The beaker containing mixture of solutions kept on Magnetic stirrer at 50rpm speed until a homogenous gel mixture is obtained. The composition of gel formulation is given in table 1.

6. Qualitative Analysis of Gel Formulation

Table 2:[4], [5], [12]

Test	F1	F2	F3
Homogeneity	Homogenous	Homogenous	Homogenous
Smear type	Non-Greasy	Non-Greasy	Non-Greasy
Colour	Reddish	Pale Reddish	Reddish

Odor	Characteristic	Characteristic	Characteristic
State	Semi-Solid	Semi-Solid	Semi-Solid
Irritancy Test	Non-Irritant	Non-Irritant	Non-Irritant
pH	5.5	5.8	5.6

6.1 Characterization of the gel

Standard methods were used for the evaluation the prepared gel formulation. The following Tests are performed on gel formulation.[5]

6.1.1. Homogeneity and smear test

The homogeneity test was done to examine the texture of the prepared gel. It showed the smooth texture of the gel when examined by physical touch. The smear of gel was applied on the skin and after- feel effect was observed, if the gel is greasy or non-greasy.[5], [6]

6.1.2. Washability test

The prepared gel was applied on the skin and after totally drying it on the skin the gel was washed under tap water to check its Washability. The Washability was examined by physical touch.[6]

6.1.3. Irritancy test

The Allergic reactions of prepared gel was observed by irritancy test. The gel was applied on the small portion of skin and 24 hour observation was done to check any allergy or irritancy. The test is later repeated on all the formulations of gel.[2], [5]

6.1.4. pH test

pH test is the most important test for any cosmetic as it is an important parameter for its efficacy as well safety. For calculation of pH, small amount of gel is dissolved in 10ml of distilled water and by using pH paper the pH is examined. For better results and efficacy of product the pH was maintained up to 5.5 to 6, which is suitable for almost all types of skin.[6]

6.1.5. Spreadability test

The Spreadability was checked of the prepared gel by placing it into two glass slides (parallel plate method). Two slides were taken and 10 gm of gel was placed on edge of one slide. The gel spread on the other side by applying pressure. Later the total spread of gel was calculated by using g.cm/s. this experiment was repeated for all the other compositions of prepared gels.[2], [5]

S= W * L/T

Where, S= Spreadability, W= Weight tied to upper side, L= Length of slide, T= time taken by upper slide.

6.1.6. Stability Test

The stability of all the prepared gel compositions was studied using pH change in the prepared gel for 1 week at same temperature. The prepared gels were stored at room temperature and After 1 week the pH is examined.

6.1.7. Antibacterial activity of gel

This test was performed to check the antibacterial activity of the gel. The effect of anti-acne gel was determined through this test. The prepared sample of gel was examined in Dayanand college of Arts and Sciences, Solapur. Microbiology Department.

The test was performed using agar diffusion method. In this the agar plate is cultured and 10gm of streptomycin bacteria is added to the gel as a standard observation. The diluted gel sample then administered in the cultured agar plate and incubated under 37 degree Celsius temperature for 24 hours. Next day the bacterial growth is observed in zone of inhibition.

7. RESULT

7.1. Homogeneity test and smear test

This test showed that the composition of herbal gel was uniform and the texture id smooth. The prepared gel was stable and did not show any phase separation for over 2 weeks at Room temperature. And the smear test showed the uniform absorption and non-greasy nature of the gel.

7.2 Washability

The prepared gel applied on small portion of skin showed easy removal of gel from skin. Which showed good washability.

7.3 Irritancy Test

From this test the prepared gel was non-irritant and caused no side effects on the applied area for 24 hours of application. All formulations showed same results.

7.4.pH test

The pH of the prepared gel was observed at room temperature showed lesser changes over a 2 weeks period of time. The pH remained constant and ranged 5.5 to 6 which is approximately natural and suitable for all skin types.

7.5.Spreadability Test

This test showed the Spreadability of the prepared gel of 10gm. It ranged 4.5 to 5.3.

Gel	Organoleptic test			Spreadability	Washability	pH	Antibacterial Activity
	Texture	Colour	Odor				
F1	Smooth	Reddish	Rose	4.5	Washable	5.5	pass
F2	Smooth	Pale Reddish	Lavender	5	Washable	5.8	pass
F3	Smooth	Reddish	Lavender	5.3	Washable	5.6	Pass

7.6. Stability

The prepared gel was kept at room temperature for up to 2weeks to check its stability. The prepared gel did not showed any phase separation or any other change in the formulation.

	Spreadability	pH	Antibacterial Activity
Series2	4.5 cm	5.5	0 m
Series3	5 cm	5.8	0 mm
Series4	5.3 cm	5.6	16 mm

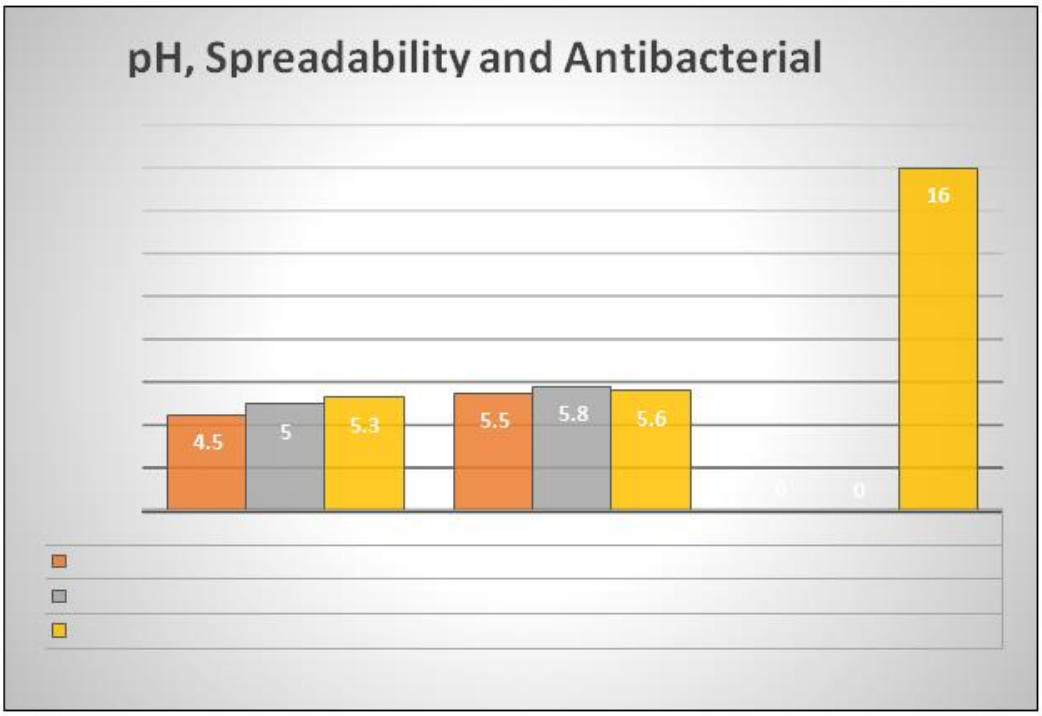

Chart-1

7.7 Antibacterial activity

The test results confirmed no contamination of bacteria in the prepared gel. Which is an indication of safe and effective gel formulation application on the skin.

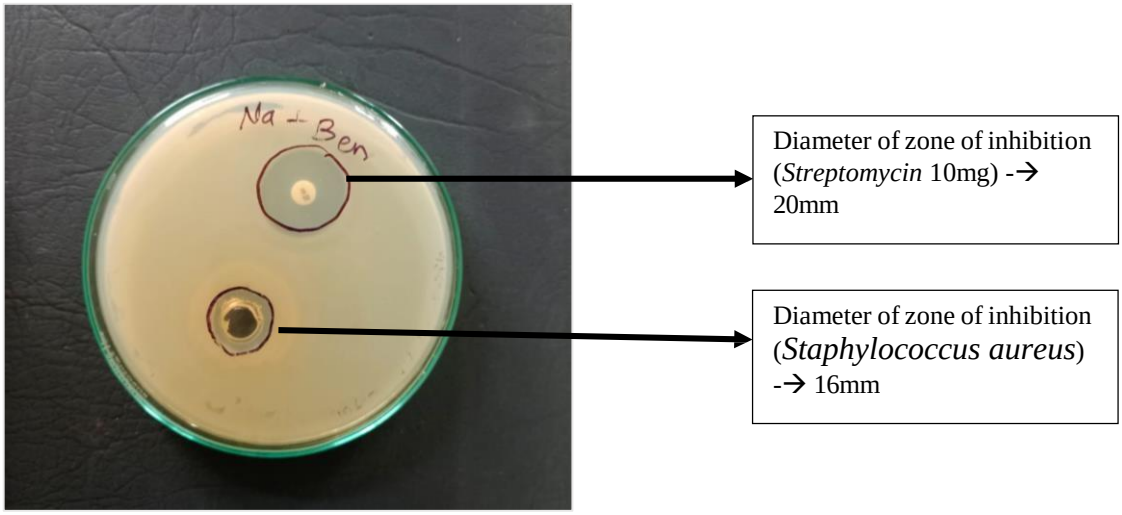

Fig. 3: Antibacterial Activity.

8. DISCUSSION

This herbal gel was prepared by using multiple raw herbs such as Tomato, Aloe vera, Honey are one of the best medicinal herbs which gives significant effect on skin when applied. This gel was prepared using appropriate measures of all the herbs in the gel base prepared from excipients later obtained a uniform mixture of gel which was homogenous and non- greasy.

Different tests are performed to examine the nature of the gel, such as pH test, Spreadability test, stability test, washability, irritancy test and antimicrobial activity of the gel. The test results were positive which showed great composition of prepared gel. The Authentification of crude drugs and there test results were also obtained from different organizations which proved credibility of the herbs.

The microbial contamination studies confirmed that no bacterial growth takes place in the prepared gel which resulted in no contamination of the gel. The non- irritancy test showed no irritation and absence of any side effect after thorough observation. And this test results confirmed that the gel is safe to be used on the skin.

9. CONCLUSION

This study mainly aimed to formulate a polyherbal semi-synthetic gel which gives anti acne activity on skin. The tomato extract, honey and aloe vera are essential herbs which provides

anti- acne activity, reduces skin damage from scars and inhibits further growth of bacteria who are responsible for inflammation and induction acne on skin due to various factors.

Based on the test results formulation 3 was selected as the best formulation. It was concluded that the present research might hopefully bring further advancement in acne treatment using herbs with lesser side effects and better effects on the skin by developing poly herbal formulations for safe and effective management of the diseases.

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