

## LIQUORICE ANTI ACNE GEL

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**ABSTRACT**

The most common skin problem that today's youth are facing is acne. Many synthetic chemical preparations like anti-acne gels are available on the market with claims that they can cure acne but possess many side effects. Hence, to overcome this problem, switching to herbal acne gel is the better option. Acne gel is a semisolid preparation that fights acne-causing bacteria. It is used to treat acne, which appears as spots or pimples on the face. Synthetic chemicals that are most commonly used in acne formulations are benzoyl peroxide, salicylic acid, etc. The major drawback of benzoyl peroxide is that it has a very short shelf life and it also has no effect on sebum production. Acne returns as soon as the medication is stopped. On the other hand, glycolic acid may cause melisma, and salicylic acid may cause skin tingling or stinging and promote dry skin and peeling. In this article, we prepared an herbal anti-acne gel by using liquorice (*Glycyrrhiza glabra Linn*), a powerful antioxidant which contains glycyrrhetic acid, which shows anti-inflammatory and anti-microbial properties that have been proven effective against *S. aureus* (acne causing bacteria). In the present article, we also evaluated it by microbial assay and thin layer chromatography. Along with that, we have added FDA approved Xanthan gum for gel like consistency and also provides hydration to the skin. We also added cucumber glycerite, which contains vitamin E that counters the free radicals that can cause acne with a small amount of preservative.

**KEYWORDS:** Liquorice, acne, glycyrrhetic acid.

**INTRODUCTION**

The skin is the largest organ in the human body, accounting for 16% of total body weight. It weighs about 5 kilogrammes and is about 2 square metres in size. It is one of our body's tissues that multiplies the most and at the fastest rate.<sup>[1]</sup> During puberty, teenagers face so many skin problems. The most common problem among all of them is acne. Acne causes severe morbidity, including scarring and psychological issues such as low self-esteem, sadness, and anxiety, all of which have a detrimental influence on quality of life.<sup>[2]</sup>

The Ayurvedic medical method is gaining popularity and prominence. It is an Indian-born, all-encompassing healthcare system. The Ayurvedic system has gained worldwide popularity due to its efficiency and lack of side effects when compared to synthetic chemicals.<sup>[3]</sup> The increased popularity of "natural cosmetics" has led to a greater usage of natural ingredients in cosmetics manufacturing. 18 $\beta$ -glycyrrhetic acid (GA) is the most important of these naturally occurring compounds. It has a wide range of antioxidative, anti-inflammatory, and antibacterial properties, among others, making it suitable for a wide range of dermatology and cosmetology

applications.<sup>[4]</sup> Liquorice (*Glycyrrhiza glabra L.*), also referred to as Yashtimadhu, gancao, Grandfather Herb, and Sweetwood or yasti-madhu, is among the most commonly used herbs in Chinese herbal therapy.<sup>[4]</sup> *Glycyrrhiza glabra* is one of the most well-known medicinal plants in the Fabaceae (formerly known as Leguminosae) family, and its relatives are now widely used as feed and food. The *Glycyrrhiza* genus gets its name from the Greek words glykos (sweet) and rhiza (root) (root). This species is native to the Mediterranean, although it has recently spread to India, Russia, and China.<sup>[5]</sup> The principal water-soluble ingredient of liquorice root is glycyrrhizic acid (GL or glycyrrhizin), a triterpenoid saponin glycoside, whereas 18 $\beta$ -glycyrrhetic acid (GA or glycyrrhetic acid) is the major metabolite of glycyrrhizic acid.<sup>[4]</sup> Glycyrrhizic acid has an anti-inflammatory mechanism that works by preventing neutrophils from producing reactive oxygen species.<sup>[6]</sup>

Cucumber glycerite was added to the formulation to improve its efficacy. Cucumber (*Cucumis sativus*) is a plant in the Cucurbitaceae family.<sup>[7]</sup> Cucumber extract is a good source of cucurbitacins, vitamin C, manganese,

and beta-carotene, according to research.<sup>[8]</sup> It hydrates the skin's surface and leaves it radiant and free of blemishes. The anti-inflammatory and anti-oxidant effects of cucumber extract are well recognized. It scavenges free radicals and slows down the ageing process on the skin's surface.<sup>[8]</sup>

### WHAT IS ACNE

Acne is a chronic inflammatory ailment of the pilosebaceous unit induced by *Propionibacterium acnes* colonisation of hair follicles on the face, neck, chest, and back as a result of androgen-induced increased sebum production, altered keratinization, inflammation, and bacterial colonisation.<sup>[9]</sup> Acne can have a negative impact on others' impressions of you because your face is frequently the first thing people see of you.<sup>[10]</sup> Non-inflammatory open and closed comedones (blackheads and whiteheads, respectively) as well as inflammatory papules, pustules, cysts, and nodules may be present.<sup>[11]</sup> Papules have no visible pus. Papule will fill with pus after few days. Once pus is discharge on the surface of skin then it's called Pustule. Severe nodulocystic acne is characterised by nodules and cysts.

Acne affects the majority of teenagers and adults. Its prestige lasts well into adolescence. Acne affects about 90% of teenagers, and half of them continue to have symptoms as adults. By the age of 40, only 1% of males and 5% of women still have lesions. According to recent studies, acne is becoming more common in children, possibly as a result of pubertal onset.<sup>[11]</sup>

### CAUSES OF ACNE

Acne has four causes: abnormal keratinocyte growth and desquamation, which produce ductal blockage; androgen-induced rise in sebum production, *Propionibacterium acnes* Proliferation and inflammation.<sup>[11]</sup>

### DISADVANTAGES OF PRESCRIPTION AND NON-PRESCRIPTION DRUGS IN ACNE

Acne can be treated without a prescription with soap and water, cleansers, benzoyl peroxide, salicylic acid, sulphur, topical retinol gel, alcohol, and acetone, however most of these are not recommended by dermatologists because it dries up the skin and provides little benefit.<sup>[12]</sup>

**1) BENZOYL PEROXIDE:** Benzoyl peroxide (BP) is a peroxide-family organic acid that has been used in the treatment of AV for over six decades.<sup>[13]</sup> This chemical is indicated for mild acne since it kills acne-causing bacteria. It normally takes at least four weeks for it to take effect, and it must be used on a regular basis to keep acne at bay. Because it has no effect on sebum production or the way skin follicle cells are removed, acne returns as soon as the medication is stopped.<sup>[12]</sup> Benzoyl peroxide has been linked to a change in the skin's barrier, as well as skin dryness and irritation in certain patients.<sup>[14]</sup>

**2) SALICYLIC ACID:** Salicylic acid has no effect on sebum production and does not destroy bacteria; therefore, it must be taken on a regular basis. Many acne products, such as lotions, creams, and pads, include salicylic acid. Salicylic acid, like benzoyl peroxide, promotes dry skin and peeling.<sup>[12]</sup> In 35 Korean patients with acne vulgaris, Lee and Kim used Salicylic acid peeling and discovered that 8.8% of them had persistent erythema that lasted more than 2 days. In 32.3 percent of instances, dryness has been documented.<sup>[15]</sup>

**PRESCRIPTION DRUGS:** Clindamycin, erythromycin, azithromycin, and clarithromycin have all been used to treat acne on a global scale. On the other hand, antibiotic resistance of *C. acnes* to clindamycin and erythromycin, on the other hand, appears to have stayed or increased during the previous four decades, particularly in Spain, India, and Egypt.<sup>[16]</sup> Erythema, peeling, itching, dryness, and burning are all minor side effects, as is pseudomembranous colitis, which is uncommon but has been recorded with clindamycin. The development of bacterial resistance and cross resistance is a major side effect of topical antibiotics. Hence, they should not be used as monotherapy.<sup>[17]</sup>

### USE OF LIQUORICE ON ACNE

**ANTI- ANDROGENIC ACTIVITIES:** Increased androgen production in the cutaneous sebaceous glands (SGs) results in increased sebum excretion and the emergence of AV.<sup>[18]</sup> Steroid sulfatase, 3beta-hydroxysteroid dehydrogenase, 17beta-hydroxysteroid dehydrogenase, steroid 5alpha-reductase, 3alpha-hydroxysteroid dehydrogenase, and aromatase are the same six key enzyme systems involved in cutaneous androgen metabolism.<sup>[19]</sup> Liquorice is an anti-androgenic plant that works through a variety of pharmacological processes. Anti-androgenic properties have been discovered in glycyrrhizin, licochalcone A, and liquorice extract whole extract.<sup>[18]</sup>

**ANTIMICROBIAL ACTIVITIES:** By activating inflammatory processes, bacteria such as *Propionibacterium acnes*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, and *Streptococcus pyogenes* play a significant part in the pathogenesis of AV. Bioactive substances against acne-causing bacteria have been found as licochalcone A, licochalcone E, and the whole extract of liquorice. Liquorice extract has been demonstrated to exhibit antibacterial activity against *P. acnes*, *S. aureus*, *S. epidermidis*, and *S. pyogenes* in vitro tests.<sup>[18]</sup>

**ANTI-INFLAMMATORY:** The primary liquorice compounds with anti-inflammatory activities have been identified as glycyrrhizin, licoflavanone, glabridin, isoliquiritigenin, licochalcone A, liquiritin, and liquiritigenin.<sup>[18]</sup>

**ANTIOXIDANT ACTIVITIES:** Antioxidants neutralise ROS and free radicals, reducing inflammation

and sebum peroxidation. ROS are produced slowly in nature and are eliminated by endogenous antioxidants such as superoxide dismutase (SOD), catalase, and glutathione. In AV patients, blood levels of these antioxidants were considerably lower than in healthy people. In topical formulations, liquorice extract has exhibited significant antioxidant and free-radical-scavenging properties.<sup>[18]</sup>

#### **OTHER USE OF LIQUORICE STIMULATORY ACTIVITY FOR HAIR GROWTH:**

The hydro-alcoholic extract of liquorice was found to promote hair development. When liquorice extract was compared to the standard medicine (2% Minoxidil), it was discovered that the 2% concentration of liquorice extract had better hair growth stimulatory activity than the 2% Minoxidil. As a result of the efficacy and safety investigation, it was shown that liquorice has considerable hair growth activity and that it may be used safely in herbal formulations to treat various kinds of alopecia.<sup>[3]</sup>

**ECZEMA:** Eczema is a recurrent, chronic atopic dermatitis (AD) characterised by itching, sleep disturbances, and a poor patient quality of life.<sup>[20]</sup> For two weeks, different quantities of liquorice extract in gel formulation were utilised, and clinical parameters such as erythema, itching, scaling, and oedema were evaluated on a four-point scale: absent = 0, mild = 1, moderate = 2, severe = 3. After one and two weeks, it was discovered that 1 percent and 2 percent gels containing liquorice extract reduced erythema, irritation, and oedema better than placebo.<sup>[21]</sup> The efficacy of an ointment containing 2% glycyrrhetic acid to treat eczema was investigated in a vehicle-controlled clinical trial.<sup>[22]</sup>

#### **MATERIAL**

Liquorice was acquired in Nagpur, Maharashtra, at a local market. Xanthan gum, glycerine, ammonia, sulphuric acid, ethanol, and distilled water were all obtained from a college laboratory, whereas distilled water was freshly prepared.

#### **METHOD**

##### **1) EXTRACTION OF GLYCYRRHETINIC ACID FROM LIQUORICE**

Procedure: Liquorice powder was soaked in 3ml of sulphuric acid and the volume was made up to 500ml with distilled water. It has been kept aside for five days. After that, it was filtered and the marc was obtained for that marc. Then the mixture was heated for 2 hours at 60°C in a water bath. After heating, the filtrate was filtered (i.e., the filtrate obtained after soaking in sulfuric acid in less amounts and the filtrate obtained after heating in more amounts). Then 15 ml of ethanol was added into it and the mixture was evaporated until a crystal was obtained.

##### **2) PREPARATION OF CUCUMBER GLYCERITE**

About 50 g of cucumber were cut into small pieces and transferred to a glass jar. To it, 50 ml of glycerine and 1 ml of butyl alcohol (a preservative) were added. Then the jar was shaken to mix all the contents. It was kept aside for around a week. After one week, the mixture was filtered and the filtrate of cucumber glycerite was obtained.

##### **3) PREPARATION OF LIQUORICE ANTI-ACNE GEL**

About 2.5 g of liquorice was added to 43.5 ml of distilled water and heated in a water bath for 30 min. Meanwhile, 2 ml of glycerine was weighed and to that 0.5 g of Xanthan gum was added. Stir it well and set this blend aside. After 30 min, liquorice extract was filtered and then slowly added to the above gum blend along with 0.1 g of crystal of glycyrrhetic acid and 1 ml of cucumber glycerite. Mix well and then add rose oil (perfume) and butyl alcohol (preservative). Keep it in the fridge for 15–20 minutes, and then transfer it to a wide-mouth container.

#### **EVALUATION OF GLYCYRRHETINIC ACID**

**THIN LAYER CHROMATOGRAPHY:** Preparation of sample: Dissolve 1mg of crystals in about 1ml of methanol chloroform (1:1) mixture.

Stationary phase: Silica gel G

Mobile phase: Toluene- ethyl acetate- glacial acetic acid (12.5:7.5:0.5)

Detecting agent: 1% vanillin-sulfuric acid

Procedure: Apply the spot over silica gel G plate and elute in the solvent system. Spray the dried plate with 1% vanillin-sulphuric acid and heat for 10 min at 110°C. Then calculate the R<sub>f</sub> value.

**MICROBIAL ASSAY:** The nutrient agar is melted, cooled to the proper temperature, and then put into a petri dish.

In the plate, the *S. aureus* culture was combined with the agar and allowed to harden.

A sterile borer is used to create cups or cavities.

The dilutions were then poured into the agar plate cups and incubated for 24 hours at 37 degrees Celsius.

The zone of inhibition will appear if the crystal has any antibacterial properties.

#### **EVALUATION PARAMETER OF GEL**

##### **PHYSICAL EVALUATION**

The formulated gel was checked for physical parameters like colour, odour, pH consistency, grittiness, washability, spreadability, etc.

1) Colour: A white background was used to examine the colour of the formulations.<sup>[23]</sup>

2) Odour: The odour of the gels was tested by dissolving them in water and smelling them.<sup>[23]</sup>

3) pH: The pH of gel was tested by using pH paper.

4) Consistency: The consistency of gel was tested by applying on skin.

5) Grittiness: The grittiness of gel was tested by applying on skin.

6) Washability: The ease and extent of washing with water were personally examined after the formulations were applied to the skin.<sup>[24]</sup>

7) Spreadability: The term "spreadability" refers to the amount of gel that spreads easily when applied to the skin or afflicted area. A formulation's medicinal efficacy is also determined by its spread value. The time it takes two slides to slip off the gel when placed in between each other under a specific stress is used to calculate spreadability. The formula

$$S = M. L/T$$

Where M is the weight attached to the higher slide, L is the length of the glass slides, and T is the time required to separate the slides.<sup>[23]</sup>

8) Skin irritancy test: Skin irritation was tested on guinea pigs (400-500 g) of both sexes. The animals were fed regular animal feed and had unlimited access to water. The animals were cared for in a routine manner. Hair was removed from the backs of guinea pigs, and a 4 cm<sup>2</sup> region on both sides was marked, with one side functioning as a control and the other as a test. The gel was applied twice a day for seven days, and the site was examined for any sensitivity. Any reaction was scored as 0, 1, 2, 3 for no reaction, minor patchy erythema, minor but confluent or substantial but patchy erythema, and severe erythema with or without oedema, respectively.<sup>[25]</sup>

## RESULTS AND DISCUSSION

Thin layer chromatography is a method of identifying specific components extracted from raw materials in order to ensure product quality control. The figure shows the spot and Rf value of the crystals was 0.41.



Figure 1 TLC of glycyrrhetic acid.

The figure shows the zone of inhibition of the microbial assay.



Figure 2 Microbial assay.

The colour of formulation was brown and has characteristic odour of rose oil. The pH of formulation was ranged from 4.5 to 5, which may be suitable for topical application without discomfort. The formulation was translucent and glossy. The formulations provided a smooth and cooling effect when applied to the skin. The consistency and washability of formulations were good.

## CONCLUSION

Acne vulgaris is the most common skin problem, and it is increasing day by day in today's youth. It has been seen that synthetic chemicals are causing so many hazardous side effects, which is causing very great damage to the skin.

Therefore, nowadays, herbal products are gaining a lot of popularity. For acne, specifically, liquorice (*Glycyrrhiza glabra linn*) has been proven very effective. In the above article, it is concluded that liquorice has anti-inflammatory and antioxidant properties which are sufficient against *S. aureus* (acne-causing bacteria).

The above evaluation of liquorice anti-acne gel includes thin layer chromatography, which is performed to identify the crystals of glycyrrhetic acid, which shows anti-inflammatory action on the acne vulgaris anti-microbial assay, which also shows a positive effect against *S. aureus*.

Hence, for the above reasons, we conclude that liquorice is a potent medicinal herbal drug and it is effective against acne-causing bacteria.

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