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ANTI-MICROBIAL AND ANTI-OXIDATIVE STUDY OF *GLYCYRRHIZA GLABRA (LICORICE).*

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ABSTRACT:
The study investigates the phytochemical properties, antimicrobial efficacy, and antioxidant potential of Glycyrrhiza glabra (licorice) extracts. Preliminary phytochemical screening revealed the presence of flavonoids, tannins, triterpenoids, alkaloids, steroids, quinones, proteins, and sugars. The antimicrobial activity was assessed using the agar well diffusion method, demonstrating significant efficacy against Staphylococcus aureus (MIC = 60 µg/mL) and moderate efficacy against Escherichia coli (MIC = 100 µg/mL). The antioxidant potential of the licorice extract was evaluated using the phosphomolybdenum reduction assay, which indicated dose-dependent activity. The results highlight the therapeutic potential of licorice extract as a source of natural antimicrobial and antioxidant agents. These findings advocate for further research to develop plant-based therapeutics targeting microbial infections and oxidative stress-related conditions.

Keywords:- *(Glycyrrhiza glabra, Phytochemical properties, Antimicrobial activity, Antioxidant potential, Natural therapeutics)*

INTRODUCTION:

Natural products have been a cornerstone of traditional medicine for centuries, providing remedies for various health conditions. They remain the primary healthcare system for a significant portion of the global population. According to the World Health Organization (WHO), approximately 80% of the global population relies on traditional medicine for primary healthcare (WHO, 2011). The therapeutic benefits of secondary metabolites derived from plants have been the subject of numerous studies, demonstrating their efficacy in treating microbial infections and oxidative stress (Mackay and Miller, 2003; Gacche and Dholen, 2006).

Medicinal plants are rich sources of bioactive compounds such as flavonoids, tannins, alkaloids, and essential oils, which contribute to their therapeutic efficacy. These compounds exhibit various pharmacological properties, including antimicrobial and antioxidant activities (Houghton et al., 2005; Ozgen et al., 2006). The exploration of such properties in plants like *Glycyrrhiza glabra* (licorice) has garnered increasing attention due to their potential as natural therapeutics.

The emergence of antibiotic resistance has heightened the need for alternative treatments. Medicinal plants, including *Glycyrrhiza glabra*, offer promising solutions by providing bioactive compounds that, combat resistant pathogens. Licorice, a perennial herb, has been extensively

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studied for its antimicrobial properties against pathogens such as *Staphylococcus aureus* and *Escherichia coli*. Moreover, its antioxidant potential, evaluated through assays like the phosphomolybdenum reduction method, highlights its ability to neutralize reactive oxygen species (ROS) and mitigate oxidative stress-related conditions (Prieto et al., 1999).

The current study investigates the phytochemical profile, antimicrobial activity, and antioxidant potential of *Glycyrrhiza glabra* extracts. By exploring these aspects, the research aims to contribute to the development of plant-based therapeutics for microbial infections and oxidative stress.

METHODS :

1. Procurement of Plant Extract

The plant extract of *Glycyrrhiza glabra* (licorice) was obtained from Hindustan Herbals. The dried root material was authenticated and stored appropriately for subsequent experimental use.

2. Phytochemical Screening

The qualitative phytochemical analysis was performed to detect the presence of bioactive compounds using standard methods (Zainol et al., 2003; Gacche & Dholen, 2006). The following tests were conducted:

- Flavonoids: A small quantum of magnesium and concentrated HCl were added to the alcoholic excerpt, and the admixture was boiled. A red achromatism indicated the presen ce of flavonoids.
- Tannins: Boric lead acetate result was added to the excerpt. The appearance of a white precipitate verified the presence of tannins.
- Triterpenoids: The dry crude extract was dissolved in chloroform, treated with acetic anhydride, and sulfuric acid was added. A reddish-violet coloration indicated triterpenoids.
- Alkaloids: Mayer's reagent was added to the extract, and the formation of a white precipitate confirmed alkaloids.
- Steroids: Steroids: The excerpt was mixed with acetic acid and acetic aldehyde, followed by sulfuric acid. A green color indicated the presence of steroids.
- Quinones: Sodium hydroxide was added to the extract. A blue-green or red color confirmed quinones.
- Proteins: The Biuret test was performed, and a violet color indicated the presence of proteins.
- Sugars: The extract was mixed with Fehling's solutions A and B, and a red precipitate formed upon heating confirmed the presence of sugars.

3. Antimicrobial Activity

The antimicrobial activity of the licorice extract was evaluated against *Staphylococcus aureus* and *Escherichia coli* using the agar well diffusion method (Bauer et al., 1966).

- Preparation of Inoculum: Bacterial strains were cultured in nutrient broth and incubated at 37°C for 24 hours then they were diluted to an optic density (OD) of 0.5(10^5 – 10^6 CFU/ mL).
- Media Preparation: Muller-Hinton agar medium was sterilized at 121°C for 15 minutes and poured into Petri dishes.
- Agar Well Diffusion: Wells of 6-8 mm diameter were created in the solidified agar using a sterile cork borer. Licorice extract solutions (20 µL) at concentrations of 20, 40, 60, 80, and 100 µg/mL were poured into the wells. Plates were incubated at 37°C for 24 hours, and

the zones of inhibition were measured to determine antimicrobial activity.

4. Antioxidant Activity

The antioxidant potential of the licorice extract was analyzed using the phosphomolybdenum reduction assay as described by Prieto et al. (1999).

- Procedure: The reaction mixture comprised 0.3 mL of the extract and 3 mL of reagent solution (0.6 M sulfuric acid, 28 mM sodium phosphate, and 4 mM ammonium molybdate). This mixture was incubated at 95°C for 90 minutes.
- Measurement: The absorbance was measured at 695 nm using a UV-VIS spectrophotometer. The antioxidant activity was assessed across extract concentrations ranging from 100 µg/mL to 500 µg/mL in a dose-dependent manner.

5. Statistical Analysis

All experiments were performed in triplicates. Data were expressed as mean ± standard deviation (SD), and statistical significance was determined using a p-value < 0.05.

RESULT & DISCUSSION:

1. Phytochemical Screening (Table 01)

The preliminary phytochemical analysis of *Glycyrrhiza glabra* (licorice) extract revealed the presence of several bioactive compounds, including flavonoids, tannins, triterpenoids, alkaloids, steroids, quinones, proteins, and sugars. These compounds are known to exhibit diverse pharmacological properties, such as antioxidant, antimicrobial, and anti-inflammatory activities (Zainol et al., 2003; Gacche & Dholen, 2006). The absence of gum was noted during the analysis. The results suggest that licorice extract is a rich source of secondary metabolites, making it a promising candidate for therapeutic applications.

2. Antimicrobial Activity (Table 02)

The antimicrobial efficacy of licorice extract was evaluated against *Staphylococcus aureus* and *Escherichia coli* using the agar well diffusion method. The zones of inhibition demonstrated dose-dependent activity, with higher concentrations showing larger zones of inhibition. At a concentration of 100 µg/mL, the inhibition zone for *S. aureus* was 14 mm, whereas for *E. coli*, it was 12 mm. The minimum inhibitory concentration (MIC) was determined to be 60 µg/mL for *S. aureus* and 100 µg/mL for *E. coli*.

The results indicate that *Glycyrrhiza glabra* exhibits more potent activity against Gram-positive bacteria (*S. aureus*) compared to Gram-negative bacteria (*E. coli*). This differential activity can be attributed to the structural differences in the bacterial cell walls, where the outer membrane in Gram-negative bacteria serves as a barrier to many plant-derived antimicrobial compounds (Bauer et al., 1966; Ahmad & Beg, 2001). These findings are consistent with previous studies that highlight the antimicrobial properties of licorice against various pathogens (Kapil et al., 1993).

3. Antioxidant Activity (Table 03)

The antioxidant potential of licorice extract was assessed using the phosphomolybdenum reduction assay. The results showed a dose-dependent increase in antioxidant activity. The absorbance values at 695 nm were recorded as follows: 0.110 (100 µg/mL), 0.198 (200 µg/mL), 0.386 (300 µg/mL), 0.815 (400 µg/mL), and 1.556 (500 µg/mL). This suggests a significant increase in antioxidant capacity with higher concentrations of the extract.

The presence of flavonoids and phenolic compounds in licorice extract contributes to its ability to scavenge free radicals and reduce reactive oxygen species (ROS). These results align with earlier studies that have established the antioxidant properties of licorice and its potential

in mitigating oxidative stress-related conditions (Prieto et al., 1999; Gacche & Dholen, 2006).

Antioxidants play a critical role in preventing cellular damage caused by free radicals, which are implicated in various degenerative diseases such as cancer, cardiovascular disorders, and aging (Halliwell & Gutteridge, 1999). The strong antioxidant activity observed in this study underscores the potential of *Glycyrrhiza glabra* as a natural source of antioxidants for therapeutic applications.

CONCLUSION:

The study highlights the therapeutic potential of *Glycyrrhiza glabra* (licorice) as a natural source of antimicrobial and antioxidant agents. The phytochemical analysis revealed the presence of bioactive compounds such as flavonoids, tannins, triterpenoids, alkaloids, steroids and quinones, which are known contributors to its pharmacological efficacy.

The antimicrobial activity of licorice extract demonstrated significant inhibition against *Staphylococcus aureus* (MIC = 60 µg/mL) and moderate inhibition against *Escherichia coli* (MIC = 100 µg/mL), emphasizing its potential for addressing infections caused by Gram-positive bacteria. Furthermore, the antioxidant activity evaluated through the phosphomolybdenum reduction assay exhibited dose-dependent efficacy, highlighting its capability to neutralize reactive oxygen species and mitigate oxidative stress.

These findings underline the dual potential of *Glycyrrhiza glabra* in combating microbial infections and oxidative damage, making it a promising candidate for plant-based therapeutic development. However, further in-depth research is essential to isolate specific bioactive compounds, elucidate their mechanisms of action, and assess their safety and efficacy in clinical settings.

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