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Review Article

**ANTIOXIDANT, ANTIMICROBIAL AND ANTIDIABETIC
ACTIVITIES OF *GLYCYRRHIZA GLABRA* (YASTIMADHU):
A REVIEW****Nisrat Jahan**

Lecturer, Dept. Of Pharmacy, Southeast University, Banani, Dhaka.

Abstract:

Glycyrrhiza glabra, licorice or yastimadhu belong to the family Fabaceae. For years the plant is used in clinical purposes due to its several pharmacological activities. Ayurvedic system consigns this plant in various preparations. Licorice possesses many therapeutic activity like antioxidant, anti-inflammatory, expectorant, tonic, diuretic, laxative, sedative, antipyretic, antimicrobial, antidiabetic and so on. The present assessment has been carried out to approximate antioxidant, antimicrobial and antidiabetic activities of plant by reviewing different journal and related articles, that might be helpful to give a thorough comprehension on licorice.

Key words: *yastimadhu*, anti-inflammatory, expectorant, tonic, diuretic, laxative.

Corresponding author:**Nisrat Jahan**

Lecturer,

Dept. Of Pharmacy,

Southeast University,

Banani, Dhaka.

E-Mail: nisrat_honey@yahoo.com

QR code



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INTRODUCTION:

Oxidative stress is a deleterious process that can damage cell structures, including lipids, proteins and DNA, which results onset of a variety of diseases including cancer, inflammation, neurodegeneration, Parkinson's disease, atherosclerosis and pre-mature aging [1]. Oxidative stress occurs because of an increase in oxidative metabolism, which produces a number of ROS including superoxide, hydrogen peroxide, hydroxyl (HO), peroxy (ROO) and alkoxy (RO) Antioxidants are known to protect the cells against the effect of free radicals through scavenging free radicals and singlet oxygen [2]. Elimination of synthetic antioxidants in food applications has given more impetus to exploring natural sources of antioxidants [3].

The diseases by pathogenic microorganisms has increased worldwide [4]. Research in the field of indigenous plants is a significant aspect of developing a safer antimicrobial principle through isolation, characterization, identification and biological studies [5]. Recently the acceptance of traditional medicine as an alternative form of health care and the development of microbial resistance to the available antibiotics have reaffirmed the need to probe the antimicrobial activity of medicinal plants. Many phytochemical compounds like phenolics, polyphenols, terpenoids, quinones act as antioxidant and antimicrobial agent [6].

Diabetes mellitus is one of the common metabolic disorders, and 2.8% of the population Suffer from this disease throughout the world and it may cross 5.4% by the year 2025. Diabetes mellitus is a group of many different diseases because hyperglycemia causes damage to eyes, kidneys, nerves, heart and blood vessels. Due to deficiency of the insulin people suffering from diabetes have high blood glucose level. The hypoglycemic effect of several plants used as antidiabetic remedies has been confirmed, and the mechanisms of hypoglycemic activity of these plants are being studied [7].

Glycyrrhiza glabra (Family Fabaceae), commonly known as licorice/liquorice, yastimodhu, mulahatti is used as medicinal plant in Asia, Southern Europe, Mediterranean. It has been a mainstay of Ayurvedic and other traditional medicines. In ancient Ayurvedic System, more than 1250 preparations are described containing licorice one of its constituents [8]. It is distributed in Southern Europe, Syria, Iran, Afghanistan, Russia,

China, Pakistan and Northern India. This plant is cultivated in Russia, UK, USA, Italy, France, Germany, Spain, China and Northern India (Punjab and Sub Himalayan tracts). Large scale commercial cultivation is seen in Spain, Sicily and England [9].

It is a perennial herb/subshrub for subtropical and temperate zone with maximum height up to 2m. The underground stem grow horizontally up to 2m length, highly branched consisting of short taproot with large number of rhizomes. The diameter of the root varies from 0.75 to 2.5 cm with grey brown exterior and yellow interior [10]. Studies on about 15 species have been studied among 30 species of *Glycyrrhiza* genus. The plant contains various phytochemical compounds like glycyrrhizin or glycyrrhizic acid, glabridin, glabrene, glabrol, licoflavonol, glycerol, licoricone, formononetin, phaseollinisoflavan, hispaglabridin A and B, 3-hydroxy glabrol, 3-methoxy glabridin, glabranin isomer, narigenin and lupiwightenone [11]. Glycyrrhizic acid (triterpene glucoside) is the principal constituent of *G. glabra* which is 50 times sweeter than sugar. The roots and rhizomes of *G. glabra* possess many clinical uses like antioxidant, antimicrobial, antidiabetic agent. Roots have demulcent, antacid, anti-ulcer [12], anti-inflammatory, expectorant, tonic, diuretic, laxative, sedative [13,14], antipyretic [15] antimicrobial, antiherpes [16], and anxiolytic [17], activities. It is also used in treatment of liver diseases, joint diseases, arthritic conditions, immunodeficiency [18], cough, tuberculosis, respiratory diseases, cancer, breast cancer cells, diabetes, endocrine disorders [19], kidney diseases [20], bronchitis, asthma, psoriasis, eczema, haemorrhoids [21], epilepsy, chronic hepatitis, heart diseases and oral diseases [22] regulate the estrogen-progesterone ratio [16,17], to protect low density lipoprotein (LDL) and red blood cells from oxidative damage [21,22].

METHODOLOGY:

Classical text books of Ayurveda and other compilatory treatises are reviewed for documenting the information about *G. glabra*. The published works on various scientific journals and web pages are consulted to review for available information about licorice in terms of phytopharmacological information [23].

RESULT:**Antioxidant activity:**

Result / Observation	Source
DPPH-radical-scavenging activity :	
1. It has been evaluated that by using Chloroform fraction was the most effective antioxidant with 87.7% activity but the activity is less than the crude methanolic extract with 90% activity.	Lateef M <i>et al</i> [24]
2. IC ₅₀ value of plant was found to be 87.152 µg/ml where IC ₅₀ of standard ascorbic acid was found to be 22.78 µg/ml.	Shapna Sultana <i>et al</i> [25]
3. Isoliquiritigenin (IL), a potent antioxidant agent from <i>G. glabra</i> has been reported.	Chin <i>et al.</i> , 2007[26]
4. IC ₅₀ value of the extracts were found to be between 588±0.86 mg/ml and 2190±1.73 mg/ml where control (ascorbic acid) was determined to be 745±0.05 mg/ml	Faruk Karahan <i>et al</i> [11]
5. Licorice roots powder showed antioxidant activity with an IC ₅₀ value of 87.152 mg/ml where ascorbic acid showed 22.78 mg/ml	Al-Bachir <i>et al</i> [27]
6. IC ₅₀ for the methanol extract of <i>G. glabra</i> was found to be 359.45 µg/ml (with a maximum of 67.22% at a concentration of 500 µg/ml) and 14.70µg/ml for standard ascorbic acid.	Gaytri <i>et al</i> [28]

Antimicrobial activity:

Result / Observation	Source
Disc diffusion method:	
1. Significant antimicrobial activity against <i>S. aureus</i> (zone of inhibition 22 mm), <i>B. subtilis</i> , <i>E. coli</i> but not against <i>P. aeruginosa</i> due to the presence of glabrene, licoisoflavone B, isolicoflavonol, gancaonin I it showed significant activity against these microorganisms.	Shapna Sultana <i>et al</i> [25]
2. <i>G. glabra</i> methanolic extracts exhibited antibacterial activity against Gram-positive (<i>S. aureus</i> , <i>B. megaterium</i> and <i>B. subtilis</i> with 22mm, 14 mm, 16 mm zone of inhibition respectively) and Gram- negative (<i>E. coli</i> , <i>P. aeruginosa</i> and <i>S. paratyphi</i> with 16 mm, 8 mm and 10 mm zone of inhibition respectively).	Shapna Sultana <i>et al</i> [25]
3. The methanolic extract of <i>G. glabra</i> showed potency against <i>S. aureus</i> at 500 µg/ml (zone of inhibition of 13 mm) amongst bacteria and showed maximum potency against <i>R. spp.</i> at 500 µg/ml (zone of inhibition of 11 mm) amongst fungi. It was least active against <i>A. awamori</i> .	Gaitry <i>et al</i> [28]
Total aerobic plate counts: High total aerobic plate counts, including <i>coliform</i> , <i>E. coli</i> and <i>Klebsiella spp.</i> , after treatment with licorice roots powder.	Al-Bachir <i>et al</i> [27]
The root extracts of <i>G. glabra</i> showed activity against <i>Mycobacterium tuberculosis</i> H37Ra and H37Rv at a concentration of 500 mg/ml	Gupta <i>et al.</i> [29]
Compounds extracted from <i>G. glabra</i> had good antibacterial activity against <i>H. pylori</i> .	Fukai <i>et al.</i> [30]
19 flavonoids isolated from <i>G. glabra</i> showed activity against methicillin sensitive <i>Staphylococcus aureus</i> (MSSA), MRSA, <i>M. luteus</i> , <i>B. subtilis</i> , <i>E. coli</i> , <i>K. pneumoniae</i> and <i>P. aeruginosa</i> .	Fukai <i>et al.</i> [31]
Remarkable activity against <i>Propionibacterium acnes</i> with negligible induction of resistance. Glabridin and glabrene possess anti methicillin resistant <i>s.aureus</i> activity.	Sabia chauhan[32]

Antidiabetic activity:

Result / Observation	Source
GAL-4-PPAR-γ chimera assay: Ethyl acetate extract of licorice exhibited a significant PPAR-γ (peroxisome proliferator-activated receptors (PPARs) are a group of nuclear receptor proteins that function as transcription factors regulating the expression of genes involved in glucose and lipid metabolism) binding activity which was attributed to seven phenolic compounds such as dehydroglyasperin, glyasperin B, glyasperin D, glycycomarin, glycyrin, glycol and isoglycyrol. Finally reduces the blood glucose level in knockout diabetic mice.	Kuroda M <i>et al</i> [33]
Glycyrrhizin has also exhibited antidiabetic activity in non-insulin dependent diabetic model	Takii H <i>et al</i> [34]
Everted rat intestinal sac model: Mucosal disappearance, serosal appearance and gut wall content in <i>G. glabra</i> (with dose of 25-100 mg/ml) was shown 79.04%, 59.87%, 19.17% while in Metformin it was 68.55 %, 52.50%, 16.05% respectively.	Nitin Gupta <i>et al</i> [35]

DISCUSSION:

The review results have estimated that the plant licorice showed higher antioxidant activity than the standard ascorbic acid in DPPH radical scavenging activity assay. Antimicrobial activities have been carried out by disc diffusive method and other methods. It was reported that the plant confirmed antimicrobial activities by acceptable zone of inhibition and inhibitory activity against different strains. Licorice showed PPAR- γ binding activity in GAL-4-PPAR- γ chimera assay and the higher percentages than the standard in various schemes in everted rat intestinal sac model. Thus *G. glabra* is found to possess potent therapeutic effect in glucose uptake.

CONCLUSION:

The overall reviews reveal that *G. glabra* is potential to treat many complicated health condition like oxidative stress, developing infection, hyperglycemia and so on. The phytochemicals present in the plant signify the plant as a noble molecule for human well being. Further significant review is needed to find out the proper estimation and revitalization on pharmacological effect.

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