ASSESSMENT OF ANTIOXIDANT ACTIVITY OF TRIBULUS TERRESTRIS AND GLYCYRRHIZA GLABRA EXTRACTS: A LITERATURE REVIEW

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ABSTRACT: *This article presents a systematic literature review on the antioxidant properties of Tribulus terrestris L. and Glycyrrhiza glabra L. extracts. Studies employing DPPH, ABTS, FRAP, and other radical scavenging assays are analyzed and compared. Key bioactive constituents responsible for antioxidant activity — flavonoids, phenolic acids, steroidal saponins, and glycyrrhizin — are discussed based on international and Uzbek scientific findings.*

Keywords: *antioxidant activity; Tribulus terrestris; Glycyrrhiza glabra; DPPH assay; radical scavenging.*

INTRODUCTION

Interest in plant-based antioxidants has increased because oxidative stress contributes to diabetes, cardiovascular disease, inflammation, and

neurodegeneration, and medicinal plants rich in phenolics are widely studied as safer complementary agents. Among traditionally used medicinal plants, Tribulus terrestris and Glycyrrhiza glabra have attracted sustained attention because both contain compounds capable of free-radical scavenging and redox modulation.

The literature shows that T. terrestris contains flavonoids, phenolic acids, tannins, alkaloids, and steroidal saponins, while G. glabra is rich in glycyrrhizin, glabridin, liquiritigenin, isoliquiritigenin, and other phenolic constituents associated with antioxidant action. The master's dissertation from Fergana State University further indicates that Uzbekistan-grown T. terrestris possesses a chemically rich profile including alkaloids and other biologically active components, supporting its relevance as a regional source for further antioxidant evaluation.

METHODOLOGY

This article is based on a focused review of peer-reviewed publications indexed through PubMed and open-access scientific repositories, with selection centered on studies reporting quantitative antioxidant data for T. terrestris or G. glabra. Preference was given to papers using recognized antioxidant assays such as DPPH, ABTS, FRAP, hydrogen peroxide scavenging, nitric oxide scavenging, and reducing power tests, because these methods allow meaningful comparison of extract performance across studies.

In addition, the previously attached master's dissertation was consulted to integrate Uzbek research context, especially regarding the phytochemical characteristics of T. terrestris collected in the Fergana region. The analysis compared extraction solvent, dominant compound classes, assay type, and reported antioxidant strength in order to identify converging findings and research gaps.

RESULTS

Tribulus terrestris. A broad review by Ștefănescu et al. reported that T. terrestris extracts demonstrate antioxidant activity in DPPH, ABTS, and FRAP systems, and that the ethyl acetate fraction often shows the strongest radical-scavenging performance because of phenolic acid derivatives such as coumaroylquinic acids. A later experimental study found that the methanol extract of T. terrestris had the highest total phenolic content at 341.3 mg GAE/g and flavonoid content at 209 mg QE/g, with DPPH IC50 of 71.4 µg/mL, FRAP of 35.3 mmol/g, and hydrogen peroxide inhibition of 65.3%. These findings support the view that the antioxidant performance of T. terrestris depends strongly on extraction polarity and phenolic enrichment.

The Fergana master's dissertation does not primarily focus on antioxidant assays, but it documents that local T. terrestris samples contain alkaloids, flavonoids, and other biologically active substances, which strengthens the rationale for evaluating Uzbekistan-grown material in future antioxidant studies. This is important because the international literature also emphasizes geographic variation in phytochemical composition and biological activity.

Glycyrrhiza glabra. For G. glabra, antioxidant activity is even more consistently documented across in vitro systems. A study on licorice root extracts showed that ethanolic extract had stronger radical scavenging than aqueous extract, with DPPH IC50 of 28.3 µg/mL, superoxide IC50 of 38.4 µg/mL, hydroxyl radical IC50 of 63 µg/mL, and ABTS IC50 of 57.2 µg/mL. These results suggest that ethanol extracts recover antioxidant constituents more efficiently than water alone. Another study found that methanolic rhizome extract of G. glabra reached 94.04% DPPH inhibition at 0.1 mg/mL, with IC50 of 35 ± 0.59 µg/mL, and linked this activity to phenolic compounds and licochalcone-type constituents. Additional work using DPPH, reducing power, and nitric oxide inhibition assays also showed that ethyl acetate extract

had especially strong antioxidant potential, likely because of its higher phenolic concentration. Comprehensive reviews of licorice phytochemistry similarly identify glycyrrhizin, glabridin, liquiritigenin, and isoliquiritigenin as major contributors to antioxidant and anti-inflammatory effects.

Comparative view

Plant	Stronger reported extract	Key assay result	Major antioxidant-related compounds
T. terrestris	Methanol / ethyl acetate pmc.ncbi.nlm.nih+1	DPPH IC50 71.4 µg/mL; FRAP 35.3 mmol/g pubmed.ncbi.nlm.nih	Flavonoids, phenolic acids, coumaroylquinic acids pmc.ncbi.nlm.nih
G. glabra	Ethanol / methanol / ethyl acetate jbiochemtech+2	DPPH IC50 28.3 µg/mL in ethanolic root extract pubmed.ncbi.nlm.nih	Glycyrrhizin, glabridin, liquiritigenin, licochalcones pmc.ncbi.nlm.nih+1

The comparison suggests that both plants are valid antioxidant sources, but G. glabra often shows lower IC50 values in DPPH-based assays than T. terrestris, indicating stronger radical scavenging under similar in vitro conditions. At the same time, T. terrestris remains scientifically relevant because of its mixed phytochemical profile and the possibility that local Uzbek populations may differ from foreign samples in composition and potency.

DISCUSSION

The reviewed evidence shows that antioxidant activity in both plants is closely linked to polar phytochemicals, especially flavonoids and phenolic

compounds, although saponins and other secondary metabolites may also contribute indirectly through redox modulation. Methodologically, DPPH remains the most frequently reported assay, but studies that combine DPPH with FRAP, ABTS, nitric oxide, and hydrogen peroxide systems provide a more reliable picture because antioxidant action is mechanistically diverse.

A major difference between the two research traditions is that licorice studies more often provide detailed comparative assay data and solvent-specific results, while T. terrestris studies frequently combine antioxidant analysis with broader pharmacological screening. Uzbek research, as reflected in the master's dissertation, contributes important phytochemical groundwork for T. terrestris, but direct antioxidant evaluation of local material remains limited and should be expanded with validated in vitro protocols.

CONCLUSION

The literature supports the conclusion that both Tribulus terrestris and Glycyrrhiza glabra are genuine natural antioxidant sources, with activity demonstrated through standard radical-scavenging and reducing-power assays. Current evidence suggests that G. glabra may show stronger in vitro antioxidant potency in several assay systems, while T. terrestris remains promising because of its chemically diverse composition and underexplored regional varieties, including Uzbek material. For future PhD-level work, the most important direction is to test Uzbekistan-grown extracts of both plants under identical experimental conditions, quantify total phenolics and flavonoids, and evaluate whether combined extracts produce additive or synergistic antioxidant effects. Such research would provide a stronger scientific basis for developing new plant-based antioxidant products relevant to both chemistry and folk-medicine-oriented товар studies.

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