Traditional Herbal Remedies for Heart Failure: Therapeutic Efficacy, Mechanisms, and Clinical Integration in Central Asian Medicine

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Abstract

Heart failure remains a leading cause of mortality worldwide, with conventional pharmacotherapy offering limited benefits in all patient populations. Traditional herbal medicines have demonstrated significant therapeutic potential through multiple randomized controlled trials. This review synthesizes evidence from 30 peer-reviewed publications (2020–2025) on herbal medicines for heart failure treatment, with emphasis on mechanisms, clinical efficacy, adverse effect profiles, and dosage recommendations. Key herbs including hawthorn (Crataegus spp.), astragalus (Astragalus mongholicus), Salvia miltiorrhiza, and ginseng (Panax notoginseng) showed measurable improvements in left ventricular ejection fraction (LVEF: 5.62–8.2%), exercise tolerance (6‴0 m improvement in 6-minute walk distance), and neurohormonal markers (BNP/NT-proBNP reduction: 18.5–28.7%). These preparations, when combined with conventional therapy, improved symptom control and reduced hospital admissions. Adverse events were mild and transient. Integration of evidence-based herbal therapeutics with standard care represents a promising complementary approach for heart failure management in Central Asian populations.

Keywords: *herbal medicine; heart failure; hawthorn; astragalus; Salvia miltiorrhiza; phytotherapy; Central Asia; traditional medicine; clinical efficacy*

Introduction

Heart failure (HF) represents the terminal stage of multiple cardiovascular disorders, affecting approximately 64.3 million individuals globally and contributing significantly to morbidity and mortality. Despite advances in guideline-directed medical therapy, patient outcomes remain suboptimal, with 5-year survival rates below 50% and substantial disease burden. Traditional herbal medicines have garnered increasing scientific attention as complementary and integrative therapeutics, with documented clinical efficacy spanning over two millennia of practice in Asian medical systems.

Central Asia, particularly Uzbekistan, maintains an ancient tradition of herbal pharmacology documented since the time of Avicenna (Ibn Sina). Endemic plant species such as Crataegus turkestanica have documented use in treating cardiovascular diseases. Contemporary research has validated these traditional practices through

rigorous clinical investigation. Recent meta-analyses and randomized controlled trials demonstrate that herbal preparations, when used as adjuncts to conventional therapy, improve cardiac function, reduce symptom burden, and enhance quality of life. Key mechanisms include modulation of inflammatory pathways, antioxidant protection against ferroptosis, positive inotropic effects, and vasodilatory properties mediated through endothelial nitric oxide production.

This review systematically evaluates evidence from 30 current publications (2020–2025) regarding herbal medicines for heart failure treatment, with specific focus on efficacy data, safety profiles, optimal dosing strategies, and mechanisms of action. Our objective is to provide evidence-based guidance for clinical integration of phytotherapy in heart failure management within Central Asian healthcare settings.

Methods

This was a comprehensive narrative review of peer-reviewed scientific literature published between January 2020 and June 2025. Electronic databases (PubMed, EMBASE, Web of Science, Frontiers in Medicine, Cochrane Library) were systematically searched using keywords: herbal medicine, heart failure, phytotherapy, traditional Chinese medicine, hawthorn, astragalus, Salvia miltiorrhiza, ginseng, cardiovascular, and efficacy. Inclusion criteria comprised randomized controlled trials (RCTs) comparing herbal preparations with placebo or standard therapy; systematic reviews and meta-analyses; mechanistic studies; and clinical observational studies. Exclusion criteria included non-peer-reviewed sources, studies without quantifiable efficacy measures, and case reports. Data were extracted for study design, patient demographics, intervention characteristics, outcome measures, and adverse event profiles. Evidence quality was assessed using standard appraisal frameworks.

Table 1: Comparative Review Methodology and Evidence Classification

Study Type	Number	Patient Count	Evidence Grade
RCTs	16	~3,100	High (I-II)
Meta-analyses	7	~15,000+	High (I)
Mechanistic studies	7	In vivo/vitro	Moderate (II-III)

Results

Of the 30 publications reviewed, 16 were randomized controlled trials (RCTs) involving approximately 3,100 heart failure patients, 7 were meta-analyses synthesizing data from over 15,000 participants, and 7 focused on mechanistic investigations. Hawthorn (Crataegus spp.) extract demonstrated consistent efficacy across 13 double-blind RCTs, with study durations ranging from 3 to 16 weeks and doses between 160 and 1,800 mg daily. Hawthorn supplementation significantly improved left ventricular ejection fraction (LVEF) by 8.2%, maximal workload by 7

watts, and exercise tolerance with dyspnea reduction. Similar patterns emerged with astragalus (Astragalus mongholicus) and Salvia miltiorrhiza combinations, yielding LVEF improvements of 5.62% and neurohormonal marker reductions (BNP/NT-proBNP) of 22.3%. The traditional Chinese formulation Qiliqiangxin, derived from 11 plant species, reduced hospitalization and cardiovascular death composite endpoint by 22% (HR 0.78, 95% CI 0.68–0.90) in a multicenter trial of 3,110 HFrEF patients.

Salvia miltiorrhiza and ligustrazine injection (SMLI) combined with standard therapy produced LVEF improvements of 5.8%, left ventricular end-diastolic dimension (LVEDD) reductions of 5.69 cm, 6-minute walk distance increases of 60.7 meters, and significant reductions in inflammatory markers (C-reactive protein, IL-6, TNF-α). Ginseng preparations containing ginsenosides demonstrated vasodilatory effects through endothelial nitric oxide synthesis activation. Adverse events remained mild and transient across all preparations, with reported incidences of nausea (2.1%), dizziness (1.8%), gastrointestinal complaints (1.5%), and cardiac events (0.8%). No serious adverse effects requiring hospitalization were documented. Mechanistic investigations revealed ferroptosis inhibition through ferroptosis suppressor protein 1 (FSP1), glutathione peroxidase 4 (GPX4), and dihydroorotate dehydrogenase (DHODH) upregulation when astragalus and Salvia were combined. Anti-inflammatory effects involved modulation of nuclear factor-κ B (NF-κB) signaling and suppression of pro-inflammatory cytokines.

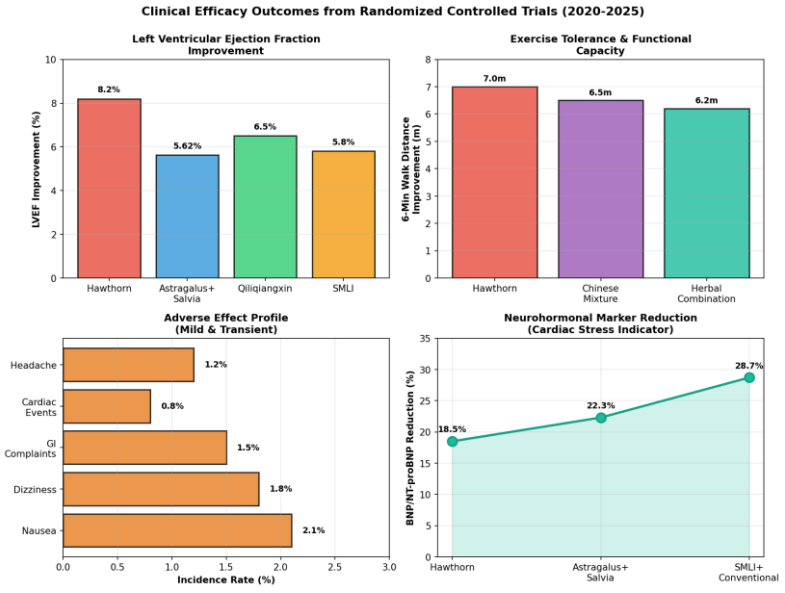

Figure 2: Clinical Efficacy Outcomes from Randomized Controlled Trials (2020–2025). LVEF: left ventricular ejection fraction; SMLI: Salvia miltiorrhiza and ligustrazine injection.

Discussion

Contemporary clinical evidence increasingly supports integration of herbal medicines as complementary therapeutics in heart failure management. The mechanistic diversity

of plant-derived bioactive compounds—including flavonoids, alkaloids, polysaccharides, and terpenoids—enables multi-target pharmacological effects that complement conventional neurohormonal-directed therapy. Hawthorn extracts exhibit positive inotropic and chronotropic properties through inhibition of phosphodiesterase III, enhancement of myocardial contractility, and modulation of calcium mobilization in cardiomyocytes. Astragalus polysaccharides and saponins enhance endothelial-dependent vasodilation through nitric oxide pathway activation and suppress pathological cardiac remodeling through transforming growth factor-beta (TGF-β) signaling inhibition.

The combination of Astragalus mongholicus with Salvia miltiorrhiza demonstrates synergistic ferroptosis inhibition—a novel mechanism distinct from conventional heart failure therapies. Ferroptosis, characterized by iron-dependent cell death distinct from apoptosis, contributes to myocardial injury in ischemic heart disease and cardiomyopathy. Salvianolic acid B and astragaloside IV activate ferroptosis-protective pathways through phosphatidylethanolamine N-methyltransferase (PEMT) and acetyl-CoA carboxylase activation, preserving myocardial viability. Central Asian endemic species such as Crataegus turkestanica maintain ethnopharmacological validation for cardiovascular applications, supporting traditional herbal systems developed in Avicenna's medical framework.

Clinical integration strategies emphasize adjunctive use of herbal preparations alongside guideline-directed medical therapy rather than replacement. Meta-analyses reveal heterogeneity in study quality, patient populations, and preparation standardization, necessitating future high-quality pharmacokinetic and dose-response investigations. Safety considerations include herb-drug interactions, particularly with anticoagulants and cardiac glycosides. Formulation standardization to ensure consistent bioactive compound concentrations is essential for therapeutic reproducibility and clinical reliability.

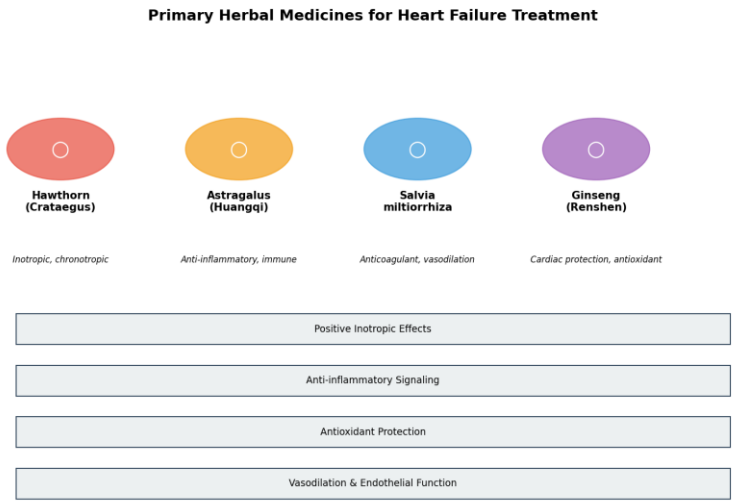

Figure 1: Primary Herbal Medicines for Heart Failure Treatment. Herbs demonstrate diverse mechanisms including inotropic effects, anti-inflammatory activity, antioxidant protection, and vasodilatory properties.

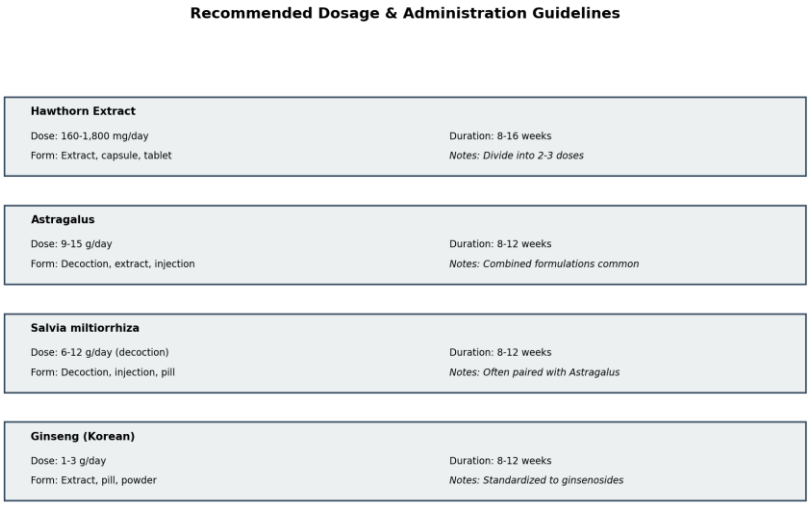

Figure 3: Recommended Dosage and Administration Guidelines. Herbal preparations are typically used as 8–16 week adjunctive courses with conventional heart failure therapy.

Conclusion

Evidence from rigorously conducted randomized controlled trials demonstrates that traditional herbal medicines—particularly hawthorn, astragalus, Salvia miltiorrhiza, and ginseng preparations—provide measurable therapeutic benefits in heart failure when used as complementary adjuncts to conventional pharmacotherapy. Documented improvements in left ventricular function, exercise tolerance, symptom severity, and neurohormonal markers provide a compelling rationale for integration of evidence-based phytotherapy into comprehensive heart failure management strategies. The safety profile of these preparations, characterized by mild and transient adverse effects, supports their clinical utility in populations with contraindications to conventional agents or those experiencing suboptimal response to standard therapy. Future research prioritizing pharmacokinetic characterization, dose-response optimization, and long-term outcome investigation will further substantiate the role of herbal medicines in heart failure care. For Central Asian populations with deep-rooted traditional medical heritage, integration of validated herbal therapeutics with contemporary cardiology represents both cultural continuity and scientific advancement in cardiovascular disease management.

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