DOI: 10.66069/ojspub.27450841

Application of Astragali Radix in Chronic Heart Failure Based on the Integrative Perspective of "Nutrient-Defensive Qi-Triple Energizer-Heart"

Yiman Zhang[1], Junru Zhang[2,*], Danlei Mao[1], Huan Zhang[1]

[1]Shaanxi University of Chinese Medicine, Xianyang 712046, Shaanxi, China;
[2]Shaanxi Provincial Hospital of Chinese Medicine, Xi'an 710003, Shaanxi, China
Correspondence Author

Abstract: ***Chronic heart failure (CHF) is a critical end-stage syndrome of various cardiovascular diseases, marked by recurrent attacks, refractory systemic deficiency and unsatisfactory long-term prognosis. Modern medicine mainly adopts symptomatic interventions, yet it is difficult to regulate and restore the deficient state induced by prolonged illness. Traditional Chinese Medicine (TCM) delivers holistic treatment and presents remarkable advantages in relieving clinical symptoms and improving patients' quality of life. From the integrative perspective of "Nutrient-Defensive Qi-Triple Energizer-Heart", this paper systematically summarizes the pathogenetic evolution of CHF. It proposes that dysregulation of nutrient-defensive qi acts as the initiating trigger, Triple Energizer stagnation serves as the core pivot, and heart-body impairment is the fundamental root of disease. Interactions among the three components contribute to the pathological progression: "disordered body-fluid distribution-retention of phlegm, static blood and fluid-malnourishment of heart vessels". Astragali Radix (Huang-qi) interrupts this vicious pathological cycle via triple mechanisms: harmonizing nutrient qi and consolidating defensive qi to regulate body fluid and blood; ascending clear qi and promoting drainage to unblock the Triple Energizer; tonifying primordial qi to nourish heart vessels. Consequently, the therapeutic objective of reinforcing deficiency and eliminating turbidity with simultaneous intervention for root causes and manifestations can be realized. Flexible herbal compatibility is suggested in clinical practice based on syndrome differentiation.***

Keywords: Nutrient-defensive qi, Triple Energizer, Heart, Astragali Radix, Chronic heart failure.

1. Introduction

Chronic heart failure is a complex clinical syndrome caused by pathological alterations of cardiac structure and function due to multiple factors, leading to ventricular systolic and diastolic dysfunction [1]. Typical clinical manifestations consist of dyspnea, chest tightness, shortness of breath, reduced exercise tolerance and limb edema. CHF remains a major clinical and public-health challenge in the 21st century accompanied by high morbidity and long-term mortality. Statistics indicated that the number of hospitalized patients with CHF reached 14.29 million across China in 2023, with a non-rehabilitation discharge rate of 10.2%, in-hospital mortality rate of 2.6% and 30-day readmission rate of 11.0% [2]. Current modern-medicine interventions include pharmacotherapy represented by the "four-pillar regimen", as well as non-pharmacological modalities such as cardiac resynchronization therapy and ventricular assist devices. Even with evidence-based treatments, CHF still severely impairs patients' quality of life, elevates readmission risk and increases long-term mortality [3].

In TCM, chronic heart failure falls under the category of "Heart-Failure (Xin Shuai)". Its pathogenesis is characterized by root deficiency and branch excess with intermingled deficiency and excess. Qi deficiency constitutes the core of root deficiency, which may be further complicated by yin-blood and yang deficiency in prolonged disease; static blood predominates in branch excess, frequently accompanied by accumulated phlegm turbidity and fluid retention [1]. The pathological evolution of deficiency-excess in CHF is consistently closely associated with nutrient-defensive qi dispersion, Triple Energizer qi-transformation and heart-vessel governance. Nutrient-defensive qi governs body-fluid dispersion over body surface; the Triple Energizer serves as the general passage for whole-body body-fluid qi-transformation; the heart vessels function as the pivot for systemic qi-blood circulation. Physiologically they share identical origin while pathologically they interact mutually. Long-standing deficiency first triggers dysregulation of nutrient-defensive qi and disturbed body-fluid distribution, which in turn obstructs the water passages of the Triple Energizer and generates pathological turbidity including phlegm, static blood and retained fluid. Over time, these pathological products continuously impair the heart entity and form a progressive pathological closed-loop: "dysregulation of nutrient-defensive qi-Triple Energizer stagnation-heart-body impairment". Based on the three-layer integrative view of "Nutrient-Defensive Qi-Triple Energizer-Heart", this article sorts out the complete pathogenetic evolution of CHF, regards Astragali Radix as the core medicinal herb and illustrates its intervention mechanisms, so as to provide multi-level and integrative TCM theoretical basis for CHF management.

2. Materia Medica Origin and Modern Pharmacological Research of Astragali Radix

2.1 Nature, Flavor, Channel Tropism and Traditional Efficacy of Astragali Radix

Astragali Radix was first documented in Shennong's Classic of Materia Medica and ranked as top-grade herb. Sweet in flavor and slightly warm in nature, it acts on the spleen and lung meridians. It is mainly produced in Inner Mongolia, Shanxi, Gansu, Heilongjiang and other regions of China [4]. Its traditional efficacies include tonifying qi and uplifting

yang, consolidating exterior to arrest sweating, inducing diuresis to alleviate edema, promoting fluid production and nourishing blood, activating qi-movement to unblock impediment, expelling toxin and discharging pus, as well as promoting granulation for sore healing. Compendium of Materia Medica Essentials records that it "warmly nourishes muscle layers and consolidates interstices" [5], explaining its actions of harmonizing nutrient-defensive qi and securing body fluid. Commentaries on the Divine Husbandman's Materia Medica states: "Astragali Radix directly enters the middle-earth and moves through the Triple Energizer… therefore it tonifies middle-qi internally, regulates nutrient qi in the middle and promotes defensive qi downward" [6]. This quote illustrates its capacity of tonifying middle-Jiao qi and facilitating nutrient-defensive qi transportation throughout interior-exterior, upper-lower parts via Triple Energizer. The same book also mentions that Astragali Radix can "expel pathogenic evil blood among five zang-organs" [6]. Rihua-zi's Materia Medica notes that it "assists qi, strengthens tendons and bones, promotes tissue regeneration, nourishes blood and dissipates abdominal masses" [7], suggesting its effects of tonifying qi to activate blood and unblock static stagnation. Thoughts on Materia Medica describes: "Astragali Radix enters Taiyang meridian so it can reach the head upward. The urinary bladder and kidney form interior-exterior relationship, hence it also reinforces kidney qi to transform yin substance and lift it upward" [8], emphasizing its efficacy against edema. Astragali Radix integrates multiple effects including qi tonification, nutrient-defensive qi harmonization, diuresis and vessel unblocking, capable of treating both Triple Energizer and nutrient-defensive qi disorders.

2.2 Modern Pharmacological Research of Astragali Radix Related to Chronic Heart Failure

Modern pharmacological studies demonstrate that Astragali Radix can activate AMPK/PGC1α and IRS/AKT signaling pathways, repair myocardial mitochondrial structure and improve myocardial energy metabolism, so as to exert anti-CHF effects [9]. The therapeutic efficacy of Astragali Radix against CHF is synergistically mediated by multiple characteristic bioactive constituents. Among them, astragaloside IV, astragalus polysaccharides and astragalus flavonoids can target and modulate PI3K/Akt, Nrf2/HO-1, TLR4/NF-κB signaling pathways, producing triple effects including anti-oxidative injury, myocardial inflammation inhibition and anti-apoptosis, thus intervening CHF via multi-pathways [10]. In clinical practice, Astragali Radix is frequently used as monarch herb in compound prescriptions and Chinese patent medicines for synergistic therapeutic effects. Qili Qiangxin Capsule functions to benefit qi and warm yang, activate blood to unblock collaterals, induce diuresis and relieve edema. Astragali Radix is heavily applied as the monarch drug in this formula. Combined with other herbs, it ameliorates palpitations, shortness of breath, lassitude, chest distress and limb edema among CHF patients. Combined administration of conventional western anti-CHF therapy plus Qili Qiangxin Capsule yields superior overall efficacy compared with western-medicine monotherapy [11].

3. Pathogenesis and Progression of Chronic Heart Failure Interpreted via "Nutrient-Defensive Qi-Triple Energizer-Heart" Integrative Perspective

3.1 Dysregulation of Nutrient-Defensive Qi: The Initiation of Disease

Nutrient qi and defensive qi both derive from food essence transformed by spleen-stomach. Nutrient qi, as yin essence, circulates within vessels and transforms into blood assisted by the heart to nourish heart yin; defensive qi belongs to yang qi, flows outside vessels, warms zang-fu organs and supports heart yang. They are mutually rooted in yin-yang and circulate in endless cycles [12]. Commentaries on the Classic of Difficult Issues states: "Human beings obtain qi from grain. Grain enters stomach… the clear part becomes nutrient qi while the turbid part becomes defensive qi; nutrient qi circulates inside vessels whereas defensive qi outside vessels… moving in cycles without termination" [13]. Physiologically, they interact closely. Firstly, nutrient yin nourishes heart yin and defensive yang warms heart yang; harmonization of heart yin-yang guarantees sufficient heart substance and regular cardiac pulsation to nourish heart entity. Secondly, nutrient qi generates blood to fill vessels; defensive qi outside vessels promotes blood flow and modulates vasomotion. Jointly they maintain dynamic balance of fluid-blood exchange inside and outside vessels and govern blood circulation. Thirdly, abundant nutrient-defensive qi ensures adequate heart yin-yang and provides material foundation for spirit generation. The diurnal fifty-cycle circulation rhythm of nutrient-defensive qi regulates the movement-stillness of heart spirit. Smooth circulation of nutrient-defensive qi stabilizes mental activities and harmonizes visceral qi movement [14-17]. The Classic of Difficult Issues puts forward: "For heart impairment, regulate nutrient-defensive qi" [18]. At early compensatory phase of CHF, deficient heart qi leads to sluggish blood circulation, gastrointestinal venous congestion and subsequent spleen-stomach injury, resulting in insufficient generation of nutrient-defensive qi. Depleted nutrient yin fails to nourish heart vessels, while deficient defensive yang cannot warm heart yang, gradually producing simultaneous deficiency of nutrient-defensive qi and dual depletion of heart qi-blood. The core function of heart governing blood circulation gets impaired in advance [12]. At this stage, severe manifestations such as dyspnea and edema have not yet occurred, yet heart-qi root is already damaged. The body's capacities of exterior defense, blood propulsion and fluid dispersion keep declining. Predisposing factors including external contraction and over-exertion readily trigger further stagnation of nutrient-defensive qi and produce pathological products such as static blood, retained fluid and phlegm turbidity, accelerating disease progression. Therefore, deficiency-induced dysregulation of nutrient-defensive qi constitutes the initiating factor of CHF.

The nutrient-defensive qi system can be analogized to myocardial energy-substrate supply system in modern medicine. Under physiological conditions, 70% of myocardial energy originates from mitochondrial oxidative decomposition of fatty-acid substrates, and ATP sustains normal cardiac systolic-diastolic function. Once heart qi gets consumed, activities of AMPK and PGC-1α pathways decline, expression of myocardial fatty-acid transporters decreases,

fatty-acid uptake becomes insufficient. The myocardium has to adopt inefficient glycolysis for compensatory energy production, leading to marked reduction of total ATP generation, which corresponds to "deficient qi" in TCM [19]. Unoxidized lipids and lactic acid accumulate within myocardial interstitium and trigger lipotoxic injury, namely "stagnation of nutrient-defensive qi". Accordingly, deficiency-caused dysregulation of nutrient-defensive qi represents the starting-point of pathological progression.

3.2 Triple Energizer Stagnation: The Pivotal Link of Disease

Treatise on Cold-Damage Diseases notes: "When nutrient qi and defensive qi lose coordination, the Triple Energizer loses its support" [20], indicating that qi-transformation of Triple Energizer relies on abundant nutrient-defensive qi. The Classic of the Central Treasury describes it as "qi of human triple origin… unobstructed Triple Energizer guarantees smooth flow throughout interior-exterior, left-right and upper-lower parts" [21]. Triple Energizer serves as the general passage for ascending-descending, exiting-entering movement of systemic qi-blood-fluid as well as excretion of pathogenic turbidity. It is divided into upper-Jiao, middle-Jiao and lower-Jiao. Upper-Jiao diffuses heart-lung qi-blood; middle-Jiao mediates spleen-stomach qi movement; lower-Jiao discharges damp turbidity. Prolonged deficiency of nutrient-defensive qi reduces the driving force for qi-blood-fluid transportation, obstructs Triple Energizer water passages and generates phlegm turbidity, static blood and fluid retention. The disease progresses from compensatory stage to decompensated phase, marking the critical turning point of deterioration.

Triple-Energizer qi-transformation corresponds to an integrated systemic metabolic regulatory network combining upper-Jiao mitochondrial energy production, middle-Jiao gut-heart-axis nutrient transportation and lower-Jiao liver-kidney turbidity excretion [22]. In CHF, deficient heart qi causes inadequate production of food essence in middle-Jiao and subsequent dysregulation of nutrient-defensive qi. Insufficient myocardial substrate supply triggers metabolic reprogramming. Massive lactic acid, reactive oxygen species and gut-derived toxins accumulate, obstructing transportation passages of qi-blood-fluid and producing Triple-Energizer stagnation. Upper-Jiao obstruction manifests as exertional dyspnea and nocturnal paroxysmal dyspnea; middle-Jiao dysfunction presents as poor appetite, lassitude and epigastric fullness; lower-Jiao disorder results in sodium-water retention and lower-limb edema. Mutual transmission of turbidity in Triple Energizer persistently activates pro-inflammatory and pro-fibrotic pathways, aggravates ventricular remodeling, further consumes essence and exacerbates nutrient-defensive qi deficiency, thus driving continuous progression of heart failure [23].

3.3 Heart-Entity Impairment: The Fundamental Root of Disease

Huangdi's Internal Classic·Suwen states: "The heart is the monarch organ where spirit manifests" [24]. All systemic blood circulation is governed by the heart. Normal cardiac systole-diastole and vascular patency depend on persistent nourishment from nutrient-defensive essence as well as unobstructed qi-transformation across Triple Energizer. Situated as the monarch zang-organ, the heart receives pectoral qi from upper-Jiao, nourishment of nutrient-defensive qi transformed by middle-Jiao spleen-stomach, and turbidity excretion via lower-Jiao water passages. Malfunction of nutrient-defensive qi and Triple Energizer will inevitably damage the heart entity over time. At early phase, dysregulated nutrient-defensive qi fails to provide proper nourishment; phlegm, static blood and retained fluid linger persistently, invade heart collaterals along vessels and interlock mutually. Huangdi's Internal Classic·Lingshu records: "When pathogenic deficiency invades… it lingers and generates masses, lodging in minute vessels or collaterals" [25], known as "mass-formation due to collateral lodging". Long-term retention of pathogenic turbidity inside collaterals induces stiffened and thickened collaterals, rigid heart entity, and inadequate nourishment for heart tissue. Heart qi, heart yin and heart yang all get depleted, forming the fundamental pathogenesis responsible for intractable symptoms and poor prognosis of advanced CHF.

Heart-entity impairment corresponds to myocardial fibrosis and irreversible ventricular remodeling in modern medicine. Oxidative toxins and gut-derived endotoxins accumulated in Triple Energizer continuously stimulate myocardium, activate pro-fibrotic pathways and trigger abnormal collagen deposition, leading to permanent impairment of cardiac systolic-diastolic function. Once heart entity deteriorates, cardiac pumping capacity declines and systemic perfusion decreases, which in turn aggravates gastrointestinal congestion, impedes essence generation and re-induces nutrient-defensive qi deficiency plus Triple-Energizer obstruction. This forms a vicious cycle, clinically manifested as orthopnea, refractory edema, emaciation and thready-unsmooth pulse [26].

3.4 Interaction of Three Components: Pathogenetic Evolution

Nutrient-defensive qi, Triple Energizer and heart are physiologically inter-connected and pathologically interactive, jointly constructing the complete pathogenesis of CHF. Under physiological conditions, spleen-stomach of middle-Jiao generates nutrient-defensive qi. Nutrient-defensive qi supplies driving force for Triple-Energizer qi-transformation; meanwhile unobstructed Triple Energizer guarantees normal transportation of nutrient-defensive qi and body fluid. Together they nourish heart vessels and maintain homeostasis of cardiac blood circulation and energy metabolism. When disease initiates, impaired heart qi and disturbed spleen-stomach transportation reduce production of nutrient-defensive qi. Dysregulation of nutrient-defensive qi serves as the initiating trigger, weakens transportation of qi-blood-fluid and gradually obstructs Triple-Energizer passages, generating pathological turbidity of phlegm-stasis-fluid retention, namely the pivotal Triple-Energizer stagnation. Long-term retention of turbidity in Triple Energizer invades heart via collaterals and continuously consumes heart qi-yin-yang, eventually producing organic damage of heart entity as the disease root. Reversely, impaired pumping function due to heart-entity injury reduces systemic visceral

perfusion, aggravates gastrointestinal congestion and essence production disorder, and re-triggers nutrient-defensive qi deficiency as well as Triple-Energizer water-passage obstruction. Consequently, a progressively deteriorating vicious pathological cycle is established.

4. Therapeutic Effects of Astragali Radix for Chronic Heart Failure from the Perspective of "Nutrient-Defensive Qi-Triple Energizer-Heart"

4.1 Harmonizing Nutrient-Defensive Qi to Regulate Body Fluid and Blood

Sweet-warm Astragali Radix acts on spleen and lung meridians. Its sweet-warm qi-tonifying property reinforces the origin of nutrient-defensive qi generation in middle-Jiao, consolidates exterior and promotes fluid production to harmonize nutrient-defensive qi in vessels and body surface. It tonifies spleen-stomach to generate food-derived essence, ameliorates deficiency of nutrient yin and defensive yang caused by qi deficiency, and restores normal transportation of qi-blood-fluid. Through tonifying qi and harmonizing nutrient-defensive qi, Astragali Radix alleviates typical manifestations of nutrient-defensive qi disharmony in early-stage CHF such as exertional shortness of breath, spontaneous sweating upon activity, poor appetite and palpitations. It blocks the pathological chain of heart-qi consumption and spleen-stomach injury and delays progression toward Triple-Energizer stagnation.

From modern-pharmacological perspective, Astragali Radix multi-dimensionally modulates myocardial energy metabolism and gastrointestinal microcirculation, improving the systemic substrate-supply system corresponding to nutrient-defensive qi. Astragaloside IV elevates activities of mitochondrial respiratory-chain complexes and pyruvate dehydrogenase, reduces lactic-acid accumulation in myocardium, balances myocardial metabolism of glucose and fatty acid, and corrects substrate-metabolism disturbance in CHF [27]. Astragalus polysaccharides repair intestinal mucosal barrier [28], ameliorate gastrointestinal congestion induced by low cardiac output and enhance absorption capacity of food essence, correcting the micro-pathological alteration of insufficient nutrient-defensive qi generation. Total astragalus flavonoids stabilize vascular endothelial cells, balance peripheral vasomotion, improve systemic fluid-blood circulation [29] and relieve circulatory disturbance corresponding to "stagnation of nutrient-defensive qi".

Clinically, for patients presenting exertional shortness of breath, spontaneous sweating on slight exertion, lassitude with poor appetite, pale tongue with thin coating and thready-weak pulse, differentiated as middle-Jiao qi deficiency and nutrient-defensive qi disharmony, the dosage of Astragali Radix is 15–30 g. For severe qi deficiency, combine with Codonopsis Radix and Atractylodis Macrocephalae Rhizoma to tonify spleen-qi and boost nutrient-defensive qi generation; for fluid-blood depletion accompanied by palpitations and dry mouth, add Angelicae Sinensis Radix and Ophiopogonis Radix to nourish fluid and blood; for mild lower-limb edema, supplement with Poria Cocos and Dioscoreae Rhizoma to fortify spleen and drain dampness.

4.2 Ascending Clear-Qi and Promoting Diuresis to Unblock the Triple Energizer

Sweet-warm Astragali Radix can lift clear qi, enter lung-spleen meridians, ascend middle-Jiao clear qi and promote drainage of Triple-Energizer water passages. It regulates qi movement of upper-, middle- and lower-Jiao: diffuses upper-Jiao heart-lung pectoral qi to relieve dyspnea; mediates middle-Jiao spleen-stomach qi movement to eliminate epigastric fullness; unblocks lower-Jiao kidney-urinary bladder to alleviate edema. It drives ascending-descending, exiting-entering movement of nutrient-defensive qi, blood and fluid, and resolves pathological conditions of Triple-Energizer obstruction caused by phlegm turbidity, static blood and fluid retention. Via its effects of ascending clear-qi, inducing diuresis and dissipating turbidity, it ameliorates manifestations in decompensated CHF including exertional dyspnea, nocturnal orthopnea, poor appetite with abdominal distension and pitting edema of bilateral lower limbs. It reduces continuous generation of pathological turbidity and prevents pathogenic turbidity from invading heart collaterals.

Modern pharmacological findings indicate that multiple active constituents of Astragali Radix modulate gut-heart axis, sodium-water metabolism and inflammatory pathways to unblock the systemic integrated metabolic network corresponding to Triple Energizer. Astragalosides repair intestinal barrier function, inhibit proliferation of harmful gut microbiota and reduce entry of gut-derived endotoxin into blood circulation, lowering accumulation of circulating pathogenic turbidity [30]. Active components of Astragali Radix improve renal perfusion and mitigate sodium-water retention to relieve lower-Jiao damp-water stagnation [31]. Astragaloside IV suppresses inflammatory factors via regulating TLR4/NF-κB/PPARα signaling pathway, alleviating persistent inflammatory stimulation exerted by Triple-Energizer turbidity upon myocardium [32].

Clinically, for patients with exertional dyspnea, difficulty in lying supine at night, poor appetite, abdominal fullness and bilateral lower-limb pitting edema, differentiated as Triple-Energizer qi stagnation and internal retention of water-turbidity, Astragali Radix is dosed at 20–35 g. For upper-Jiao lung-qi congestion with cough and copious sputum, combine with Armeniacae Semen Amarum and Perillae Fructus to diffuse and descend lung-qi; for middle-Jiao spleen-stomach qi stagnation with epigastric fullness and poor appetite, add Citri Reticulatae Pericarpium and Magnoliae Officinalis Cortex to move qi and harmonize stomach; for severe lower-Jiao damp-water flooding and marked edema, supplement with Polyporus and Alismatis Rhizoma to promote diuresis and unblock water passages.

4.3 Tonifying Primordial-Qi to Nourish Heart Vessels

Astragali Radix heavily tonifies lung-spleen primordial-qi, reinforces the root of systemic qi-blood generation. It harmonizes nutrient-defensive qi and unblocks Triple Energizer simultaneously, blocks persistent invasion of heart

collaterals by phlegm-static-water turbidity, and gradually restores heart qi, heart yin and heart yang. It alleviates critical manifestations in end-stage CHF induced by "mass-formation due to collateral lodging" caused by long-term retention of pathogenic turbidity in heart collaterals, such as orthopnea, intractable generalized edema, emaciation and lassitude.

Modern pharmacological research reveals that active constituents of Astragali Radix target fibrotic, inflammatory and apoptotic pathways to ameliorate organic heart-entity injury. Astragalus polysaccharides suppress excessive activation of TGF-β1/Smad3 signaling pathway, reduce abnormal deposition of type-I and type-III collagen, decrease ventricular wall stiffness and delay myocardial fibrosis as well as ventricular remodeling so as to slow CHF progression [33].

Clinically, for patients with orthopnea, severe generalized edema, emaciation, severe palpitations, dark-colored tongue and deep-unsmooth pulse, differentiated as primordial-qi deficiency, collateral injury by pathogenic turbidity and heart-entity impairment, Astragali Radix dosage ranges from 30 g to 40 g. For heart-qi-yang deficiency accompanied by cold-aversion and cold extremities, combine with Cinnamomi Ramulus and Aconiti Radix Lateralis Preparata to warm and unblock heart-yang; for severe collateral stasis with ecchymoses on tongue, add Salviae Miltiorrhizae Radix et Rhizoma and Persicae Semen to activate blood and unblock collaterals; for overwhelming water-turbidity and refractory edema, supplement with Descurainiae Semen Lepidii Semen and Plantaginis Semen to purge turbidity and induce diuresis.

5. Conclusion

Based on TCM holistic view, this paper constructs a theoretical system for pathogenesis and treatment of CHF centering on Astragali Radix from "Nutrient-Defensive Qi-Triple Energizer-Heart" integrative perspective. This theory clarifies the progressive pathological chain of CHF: initial heart-qi deficiency triggers dysregulation of nutrient-defensive qi and disturbed body-fluid distribution as the initiating trigger; malnourished nutrient-defensive qi induces disorder of Triple-Energizer qi-transformation and obstruction of passages by phlegm-stasis-fluid turbidity, serving as the pivotal pathological link; long-term retention of pathogenic turbidity invades heart collaterals, depletes heart qi-yin-yang and produces organic heart-entity injury as the root of disease. Interplay of these factors forms a self-amplifying vicious pathological cycle of "disordered fluid distribution-retention of phlegm-static-fluid-malnourished heart vessels".

In terms of intervention mechanisms, relying on multi-component and multi-target pharmacological advantages, Astragali Radix realizes three-layer integrated regulation. Firstly, sweet-warm property of Astragali Radix enters spleen-lung meridians to tonify the source of nutrient-defensive qi generation. Astragaloside IV corrects myocardial substrate-metabolism disturbance; astragalus polysaccharides ameliorate gastrointestinal congestion to facilitate essence absorption; total astragalus flavonoids protect endothelium and unblock systemic fluid-blood circulation. Thereby it harmonizes nutrient-defensive qi and secures fluid-blood to slow down pathological progression at early CHF phase marked by qi deficiency and impaired transportation. Secondly, it ascends clear qi and promotes diuresis to unblock systemic metabolic network of Triple Energizer. Astragalosides modulate gut microbiota and reduce accumulation of gut-derived endotoxin; active constituents improve renal perfusion and relieve sodium-water retention; flavonoid components inhibit release of inflammatory factors, resolve phlegm-damp-water turbidity in Triple Energizer and delay myocardial injury induced by persistent pathogenic turbidity in intermediate stage. Thirdly, it tonifies primordial-qi and nourishes heart vessels. Astragalus polysaccharides inhibit TGF-β1/Smad3 pathway and reduce collagen deposition, delaying myocardial fibrosis and irreversible ventricular remodeling, and ameliorate critical complex deficiency-excess status in end-stage CHF. Traditional TCM therapeutic actions of "harmonizing nutrient-defensive qi, unblocking Triple Energizer, tonifying qi to nourish heart" get mutually validated by modern pharmacological evidence, fully demonstrating the unique advantages of Chinese herbal medicine for holistic multi-pathway intervention for CHF.

Nevertheless, deficiency-excess pathogenesis of CHF is highly complex and intertwined in clinical practice. Monotherapy with Astragali Radix hardly covers the full-course complex pathological changes. Syndrome-differentiation combined with disease-differentiation should be adopted for integrated Chinese-western collaborative diagnosis-treatment. Standard western-medicine regimens such as "four-pillar therapy" control basic indicators of CHF; meanwhile Astragali Radix is taken as core herb for flexible modification combined with therapies including lung-diffusion, middle-Jiao harmonization, diuresis, blood-activation and yang-warming. Compound Chinese patent medicines such as Qili Qiangxin Capsule can also be used for synergistic intervention. Via triple effects of Astragali Radix ("harmonizing nutrient-defensive qi to regulate fluid-blood; ascending clear-qi and promoting drainage to unblock Triple Energizer; tonifying primordial-qi to nourish heart vessels"), complementary to western symptomatic therapy, multiple objectives can be achieved: ameliorating short-term clinical symptoms, delaying ventricular remodeling, lowering readmission rate and reducing long-term mortality risk. It provides theoretical ideas with TCM characteristics for stratified and integrative Chinese-western diagnosis and management of chronic heart failure.

References

[1] Guidelines for TCM Diagnosis and Treatment of Chronic Heart Failure (2022). J Tradit Chin Med. 2023; 64(7):743-756.

[2] Liu MB, He XY, Yang XH, et al. Interpretation of key points in Report on Cardiovascular Health and Diseases in China 2024. J Cardiovasc Pulm Dis. 2025; 44(9): 899-917.

[3] Ciuca-Pană MA, Boulmpou A, Ileri C, et al. Chronic Heart Failure and Coronary Artery Disease: Pharmacological Treatment and Cardiac Rehabilitation. Medicina (Kaunas). 2025;61(2):211.

[4] Shen YT, Feng XD. Research progress on active constituents of Astragali Radix and its compound

prescriptions for ischemic stroke. Chin J Exp Tradit Med Formulae.
[5] Wang A. Compendium of Materia Medica Essentials. Beijing: People's Military Medical Press; 2007:6.
[6] Zou S. Commentaries on the Divine Husbandman's Materia Medica. Beijing: China Press of Traditional Chinese Medicine; 2013:74.
[7] Chang MY. Annotation of Rihua-zi's Materia Medica. Beijing: China Medical Science Press; 2016:31.
[8] Zhou Y. Thoughts on Materia Medica. Taiyuan: Shanxi Science and Technology Press; 2015:29.
[9] Zhang C, Zhu Y, Wang M, Chen R, Sun X. Comparison of chemical composition between imitation wild and transplanted Astragali Radix and their therapeutic effects on heart failure. J Ethnopharmacol. 2025;337(Pt 1):118827.
[10] Li M, Han B, Zhao H, et al. Biological active ingredients of Astragali Radix and its mechanisms in treating cardiovascular and cerebrovascular diseases. Phytomedicine. 2022;98:153918.
[11] Wang F. Clinical observation of Qili Qiangxin Capsule adjuvant therapy for coronary heart disease complicated with chronic heart failure. J Pract Tradit Chin Med. 2026;42(4):772-775.
[12] Wang J, Liu FM. Discussion on syndrome differentiation and treatment of chronic heart failure based on the theory of "For heart impairment, regulate nutrient-defensive qi". Jiangsu J Tradit Chin Med. 2023;55(11):10-13.
[13] Wang JS, Mu JX. Commentaries on the Classic of Difficult Issues. Beijing: China Medical Science Press; 2019:79.
[14] Yang PY, Meng ZY, Hou Y, et al. Exploration on treating variant angina pectoris from nutrient-defensive qi theory. Shandong J Tradit Chin Med. 2024; 43(2): 114-117.
[15] Wu XC, Jia ZH, Wei C, et al. Analysis of nutrient-defensive qi relationship in Huangdi's Internal Classic. Chin J Basic Med Tradit Chin Med. 2011; 17(2): 127-129.
[16] Jia BC, Wei JL, Cheng T, et al. Pathogenesis and therapeutic thinking of Helicobacter pylori-induced atrial fibrillation from "heart-spleen correlation and harmony of nutrient-defensive qi". J Beijing Univ Tradit Chin Med. 2023;46(11):1592-1598.
[17] Chen AS, Wang T. Brief discussion on application of Zhang Zhongjing's formulas in dual heart-mind disorders based on "For heart impairment, regulate nutrient-defensive qi". Clin J Chin Med. 2026; 18(3): 25-28.
[18] Qin Y. The Classic of Difficult Issues. Guangzhou: Guangdong Science and Technology Press; 2022:11.
[19] Xu ZC, Huang GX, Wang Q. Research progress of TCM intervention for chronic heart failure based on "treating from spleen". J Pract Tradit Chin Intern Med.
[20] Zhang ZJ, Wang SH. Treatise on Cold-Damage Diseases. Beijing: China Press of Traditional Chinese Medicine; 2022:14.
[21] Hua Tuo. The Classic of the Central Treasury. Beijing: Xueyuan Press; 2007:44.
[22] Li LY, Gao B, Liu P, et al. Exploration on metabolic reprogramming mechanism of chronic heart failure based on Triple-Energizer qi-transformation theory. J Anhui Univ Chin Med. 2026;45(1):5-8.
[23] Dong GJ. Ideas of TCM staging prevention and treatment for heart failure with preserved ejection fraction based on Triple-Energizer qi-transformation theory. J Chin Med. 2023;41(4):1-3.
[24] He WB, Tan YS. Huangdi's Internal Classic·Suwen. Beijing: China Medical Science Press; 1998:49.
[25] Huang Di, Qi Bo. Huangdi's Internal Classic. Shenyang: Wanjuan Publishing Company; 2009:414.
[26] Liu SY, Dong GJ. Interpretation of expert consensus on staged diagnosis of integrated TCM-western medicine for heart failure with preserved ejection fraction. J Chin Med. 2024;42(1):112-117.
[27] Wang X, Chen X, Wang Y, et al. Astragaloside IV alleviates inflammation and improves myocardial metabolism in heart failure mice with preserved ejection fraction. Front Pharmacol. 2024;15:1467132.
[28] Yang BB, Cui N, Wang SJ. Mechanism of astragalus polysaccharides on repairing small-intestinal mucosal injury in spleen-deficiency-damp-stagnation rats based on Wnt/β-catenin signaling pathway. J Nanjing Univ Tradit Chin Med. 2022;38(1):77-82.
[29] Liu Q, Zhang L, Shan Q, et al. Total flavonoids from Astragalus alleviate endothelial dysfunction by activating the Akt/eNOS pathway. J Int Med Res. 2018; 46(6): 2096-2103.
[30] He J, Wang M, Yang L, et al. Astragaloside IV Alleviates Intestinal Barrier Dysfunction via the AKT-GSK3β-β-Catenin Pathway in Peritoneal Dialysis. Front Pharmacol. 2022;13:873150.
[31] Liu Y, Huang Y, Sun D, et al. Research progress of astragaloside IV in treating acute kidney injury. Int Urol Nephrol. 2024;56(8):2645-2650.
[32] Zhang X, Li M, Wang H. Astragaloside IV Alleviates the Myocardial Damage Induced by Lipopolysaccharide via the Toll-Like Receptor 4 (TLR4)/Nuclear Factor kappa B (NF-κB)/Proliferator-Activated Receptor α (PPARα) Signaling Pathway. Med Sci Monit. 2019; 25: 7158-7168.
[33] Qin N, Wu W, Li B. Astragalus Polysaccharide Improves Myocardial Fibrosis in Hypertrophic Cardiomyopathy Through the TGF-β1/Smad3 Signal Pathway. Front Biosci (Landmark Ed). 2025; 30(10): 45595.