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Review Article

Integrative insights on cardiovascular health: A comparative review of traditional Persian medicine and contemporary cardiological approaches

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Abstract

Objective: This narrative review examines the intersections between Traditional Persian Medicine (TPM) and modern cardiology in the understanding, prevention, and treatment of cardiovascular diseases (CVDs).

Materials and methods: Literature was sourced from PubMed, Scopus, and Google Scholar for the period from January 2015 to August 2025, supplemented with classical TPM texts beyond this date range. Priority was given to original clinical trials, cohort studies, and experimental investigations whenever primary evidence was available.

Results: The reviewed literature identified potential cardiovascular benefits of selected medicinal plants, including garlic, saffron, pomegranate, cinnamon, and hawthorn, through antihypertensive, antioxidant, anti-inflammatory, endothelial-protective, and cardiometabolic effects. Lifestyle and dietary interventions also showed conceptual alignment between TPM and contemporary cardiovascular prevention. However, evidence for TPM-specific concepts, including *hararat*, *mizaj*, and pulse-based diagnosis, remains predominantly conceptual or exploratory, with limited clinical validation. Major gaps include non-standardized diagnostic criteria, variability in herbal preparations and dosages, limited herb–drug interaction data, heterogeneous clinical studies, and insufficient multicenter randomized trials.

Conclusion: Evidence from regenerative medicine, psycho-cardiology, and AI-assisted tools is incorporated to propose a multidisciplinary model bridging ancient wisdom and modern science. The findings suggest that TPM may provide complementary preventive and personalized cardiovascular strategies; however, substantial heterogeneity and limited clinical standardization remain important barriers to evidence-based implementation, and further large-scale clinical trials, mechanistic investigations, and standardized herbal protocols are required before broad clinical implementation.

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Introduction

Cardiovascular diseases (CVDs) are the leading cause of global mortality and disability-adjusted life years, with total deaths reaching 19.2 million in 2023 according to the latest data (WHO 2025). Beyond conventional risk factor modification, evidence highlights the role of antioxidant-rich fruits in modulating endothelial function and inflammation to reduce cardiovascular risk (Abazari et al. 2024; Keihanian et al. 2023). Traditional Persian Medicine (TPM) provides valuable insights here. This review integrates historical TPM knowledge, including Avicenna's recommendations for fruits like pomegranate, with contemporary studies to explore mechanistic pathways and therapeutic potentials (Kordafshari et al. 2015; Zarshenas et al. 2016). Rather than presenting TPM concepts merely as historical descriptions, this review critically interprets them alongside modern cardiovascular mechanisms including endothelial dysfunction, oxidative stress, autonomic imbalance, and mitochondrial energetics.

Bioactive compounds from medicinal herbs counteract oxidative stress, with extracts of *Curcuma longa*, *Allium sativum*, and *Vitis vinifera* reducing low-density lipoprotein cholesterol (LDL-C) and inflammation in high-risk patients (Li et al. 2015; Rastogi et al. 2016). TPM categorizes such plants by temperament (*mizaj*) and effects on cardiac vital force, providing a framework for understanding systemic actions. Importantly, TPM concepts such as *mizaj* and *hararat* are interpreted in this review as functional explanatory models rather than direct biomedical equivalents. Combining traditional classifications with modern pharmacology aids in developing multi-targeted CVD therapies (Li et al. 2015; Sobhani et al. 2017).

Among complementary medical systems, TPM offers novel therapeutic approaches to CVD through dietary regulation and herbal tonics that align with modern lifestyle medicine (Ebrahimi et al. 2019; Keihanian et al. 2023; Maierean et al. 2017; Rastogi et al. 2016; Sobhani et al. 2017). Validated treatments like *Crocus sativus* (saffron) for angina and *Punica granatum* (pomegranate) for atherosclerosis show promise in influencing endothelial dysfunction and oxidative stress (Baharvand-Ahmadi et al. 2016; Keihanian et al. 2023). Additionally, several TPM interventions may exert simultaneous antioxidant, anti-inflammatory, endothelial-protective, and psycho-cardiological effects, supporting the concept of multi-target cardiovascular therapy (Yousaf et al. 2022).

TPM's detailed pharmacopeia includes over 50 plants documented in Avicenna's Treatise on Cardiac Drugs. Contemporary studies confirm plants like *Cinnamomum verum* contain bioactive compounds that modulate nitric oxide synthesis and reduce platelet aggregation (Baharvand-Ahmadi et al. 2016; Keihanian et al. 2023; Li et al. 2015; Rahman and Jamal 2020), highlighting their potential as multi-modal interventions (Al-Worafi 2025; Sobhani et al. 2017). However, despite promising pharmacological findings, substantial heterogeneity exists regarding herbal preparation methods, dosage standardization, and clinical outcomes, necessitating further large-scale randomized clinical trials.

The increasing prevalence of early-onset CVD, driven by sedentary lifestyles and high-calorie diets, is a particular concern (WHO 2025; Zhang et al. 2023). TPM conceptualizes these risk factors through disruptions in *mizaj* (temperament) (Salmannezhad et al. 2017), , waste accumulation (Bano et al. 2023), and imbalance in *hararat* (Noor et al. 2019). TPM-inspired diets rich in pomegranate and citrus fruits can modulate lipid profiles and reduce systemic inflammation (Abazari et al. 2024; Keihanian et al. 2023), creating opportunities for culturally relevant, evidence-based prevention. These traditional preventive principles share important similarities with contemporary

lifestyle medicine and preventive cardiology approaches emphasizing nutrition, stress reduction, and behavioral modification.

Oxidative stress and endothelial dysfunction are critical in CVD pathogenesis. Within the TPM framework, related disturbances may be interpreted through concepts of diminished cardiac vitality and *hararat* imbalance (Vaghasloo et al. 2017a). Modern research confirms that plant-derived antioxidants can restore endothelial nitric oxide synthase (eNOS) activity and reduce vascular oxidative damage (Keihanian et al. 2023; Rastogi et al. 2016). Integrating these insights with the TPM pharmacopeia enables a systematic exploration of candidate herbs and foods. Recent advances in mitochondrial biology and vascular inflammation further support investigation into possible functional overlaps between TPM concepts of *hararat* and modern understandings of metabolic and endothelial regulation (El-Gammal et al. 2022; Faro et al. 2024).

Digital health tools can bridge traditional knowledge and modern care. A 2023 telemedicine model for TPM demonstrated potential for remote counseling and monitoring in CVD patients (Nafisi and Ghods 2021). Such integration may enable larger-scale validation of TPM interventions, aligning with World Health Organization (WHO) initiatives to integrate traditional medicine into health systems (von Schoen-Angerer et al. 2023). Moreover, recent developments in artificial intelligence and machine-learning-assisted pulse analysis may facilitate quantitative evaluation of traditionally qualitative TPM diagnostic methods (Muse and Topol 2024; Nafisi et al. 2022).

This review provides a comprehensive analysis of TPM-based approaches to cardiovascular health, covering historical concepts and modern pharmacological evidence for frequently cited fruits and herbs (Abazari et al. 2024; Keihanian et al. 2023; von Schoen-Angerer et al. 2023). By bridging traditional knowledge with evidence-based cardiology, it identifies promising candidates for future clinical trials and integrative healthcare models (Sobhani et al. 2017; Zhang et al. 2023). The review additionally evaluates theoretical limitations, translational challenges, and opportunities for integrating TPM principles into personalized and preventive cardiovascular medicine.

Materials and Methods

This narrative review synthesizes evidence from Traditional Persian Medicine (TPM) and modern cardiology. We searched PubMed, Scopus, Web of Science, and Google Scholar for the period from January 2015 to August 2025 using keywords including "Traditional Persian Medicine," "cardiovascular disease," and "herbal medicine," supplemented by classical TPM texts without date restrictions. For TPM sources, we extended the time range of our search. Priority was given to original clinical trials, cohort studies, and experimental investigations whenever primary evidence was available. The narrative approach enabled conceptual synthesis across both systems. To preserve analytical depth despite the interdisciplinary scope, the review was organized around major thematic domains including cardiovascular physiology, preventive cardiology, psycho-cardiology, herbal medicine, regenerative medicine, and digital health applications. We included peer-reviewed articles, clinical trials, and reviews addressing TPM interventions, their pharmacological evidence, or integrative models, excluding non-peer-reviewed commentaries. Data on study design, interventions, and outcomes were extracted and thematically organized to align TPM principles (e.g., *mizaj*, and *hararat*) with modern physiological concepts. Importantly, TPM concepts were interpreted as functional explanatory frameworks rather than direct biomedical equivalents. Special attention was given to

recent advances in regenerative medicine, psycho-cardiology, and digital health applications like AI-assisted pulse analysis (Nafisi et al. 2022; Vaghasloo et al. 2017b). The review additionally evaluated inconsistencies in current evidence, including variability in herbal preparations, dosage standardization, methodological heterogeneity, and limitations in translational clinical studies.

Results

The anatomy and physiology of the heart in TPM

In TPM, the heart is described as being positioned slightly left in the chest, protected by the ribcage and connected to the circulatory system via major vessels (Chamsi-Pasha and Chamsi-Pasha 2014). Its primary role is to circulate blood, which carries essential nutrients and innate heat (*hararat*), a vital force that sustains life. This circulation is fundamental for maintaining the balance of the four humors (*akhlaat*)—blood (Dam), phlegm (*balgham*), yellow bile (*safra*), and black bile (*sauda*)—with imbalances leading to disease (Kordafshari et al. 2015; Nimrouzi and Zare 2014). Figure 1 illustrates the evolution of these TPM principles and their alignment with modern cardiovascular science.

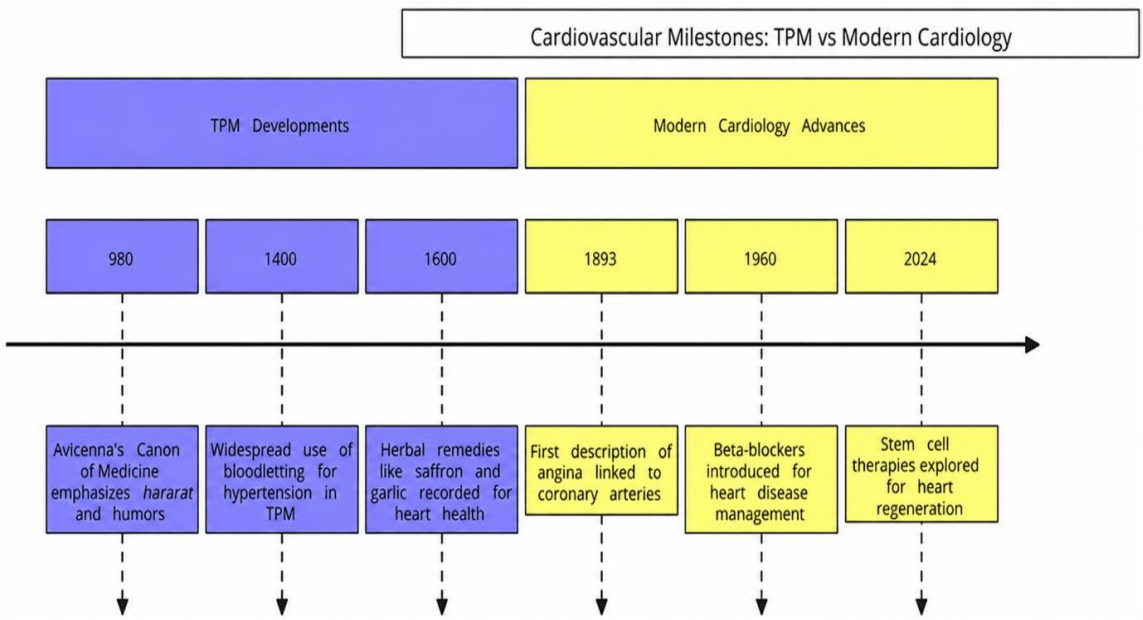

Figure 1. Milestones and chronology of cardiovascular insights in traditional Persian medicine (TPM)

TPM anatomical descriptions share structural parallels with modern anatomy, particularly the heart's central pumping role. However, TPM incorporates a broader functional and metaphysical dimension in its description of *hararat*, linking it to vitality and the maintenance of physiological balance. Rather than interpreting *hararat* as a literal equivalent of body temperature, this review considers it a functional concept potentially overlapping with metabolic activity, vascular responsiveness, mitochondrial energetics, and systemic vitality (El-Gammal et al. 2022; Kruglov et al. 2023).

Nevertheless, these parallels should be regarded as interpretive and hypothesis-generating rather than direct physiological equivalences.

Innate heat (*hararat*) and its significance

Hararat (innate heat) is a vital life force in TPM, primarily generated in the liver and distributed by the heart (Ebrahimi et al.

2019; Vaghasloo et al. 2017a). It is crucial for all metabolic processes, digestion, thermoregulation, and defense mechanisms (Talebi et al. 2020). In TPM, *hararat* is also associated with vitality, tissue nourishment, emotional balance, and maintenance of cardiovascular integrity.

The balance of *hararat* is essential for health; equilibrium supports optimal function, while excess or deficiency causes disease. Excess *hararat* is linked to blood "thickening" and hypertension, while deficiency impairs circulation, predisposing to heart failure or ischemia (Baharvand-Ahmadi et al. 2016; Noor et al. 2019; Vaghasloo et al. 2017a). Importantly, *hararat* should not be interpreted as a direct equivalent of body temperature alone, but rather as a functional concept potentially overlapping with metabolic regulation, mitochondrial energetics, autonomic balance, and vascular responsiveness (El-Gammal et al. 2022; Schirrmacher 2020).

Modern concepts like mitochondrial energy production and thermogenesis parallel this TPM view, illustrating its holistic approach. Recent evidence suggests that mitochondrial dysfunction contributes significantly to endothelial injury, oxidative stress, impaired vascular adaptation, and chronic cardiovascular disease, providing potential mechanistic parallels to TPM descriptions of weakened *hararat* (Kruglov et al. 2023; Schirrmacher 2020).

Cardiovascular impact of *hararat*

In cardiovascular health, *hararat* regulates blood temperature and fluidity, essential for circulatory balance (Eram et al. 2023). Balanced *hararat* ensures smooth blood flow, preventing hypertension, IHD, and heart failure. Deficient *hararat* causes thick, sluggish blood leading to ischemia or failure, while excess causes overheating, increasing vascular resistance and hypertension (Akbari et al. 2022; Vaghasloo et al. 2017a). Thus, controlling *hararat* is a central therapeutic target in TPM. Studies on TPM herbs like *Punica granatum* and Crocus sativus support this, showing improved blood fluidity and endothelial protection (Abazari et al. 2024; Keihanian et al. 2023). These findings are particularly relevant because endothelial dysfunction and vascular inflammation are now recognized as major contributors to hypertension, atherosclerosis, and ischemic cardiovascular disease (Faro et al. 2024) (Figure 2).

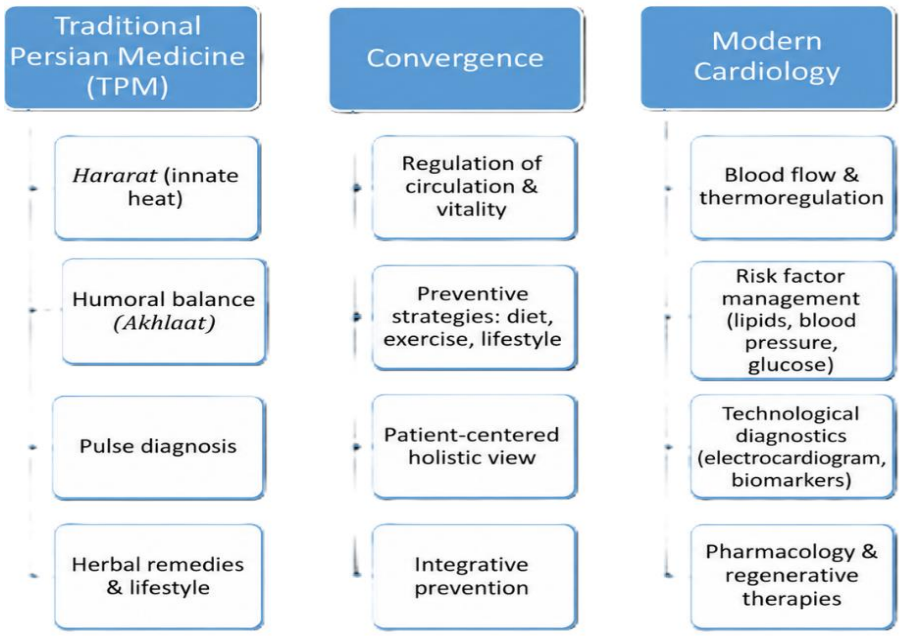

Figure 2. Comparative Relationship between Traditional Persian Medicine (TPM) and Modern Cardiology

However, despite conceptual similarities between TPM theories and modern cardiovascular physiology, these relationships remain interpretive rather than directly validated. Further translational and mechanistic studies are required to determine whether TPM concepts such as *hararat* can be quantitatively correlated with measurable cardiovascular biomarkers.

Pulse as a diagnostic tool

In TPM, the pulse (*nabz*) is a crucial diagnostic tool for assessing humoral balance and *hararat* (Nafisi et al. 2022; Vaghasloo et al. 2017b). Its characteristics—rhythm, strength, and rate—provide insights into cardiovascular and general health. TPM literature dedicates significant attention to pulse diagnosis, highlighting its clinical importance (Kordafshari et al. 2015; Vaghasloo et al. 2017a; Vaghasloo et al. 2017b).

The pulse reflects the heart's capacity to generate *hararat* and regulate blood flow. By assessing its force, speed, and regularity, practitioners identify humoral imbalances and related diseases (Noor et al. 2019; Vaghasloo et al. 2017b). A forceful, rapid pulse may indicate excess *hararat*, while a weak, slow pulse suggests a deficiency, often linked to cold humors like phlegm or black bile. Modern cardiovascular medicine similarly recognizes pulse characteristics, arterial stiffness, and heart rate variability as important indicators of autonomic regulation and vascular health.

Recent advances in artificial intelligence and wearable biosensors have enabled quantitative analysis of pulse waveforms using machine-learning algorithms (Muse and Topol 2024; Nafisi et al. 2022). AI-assisted pulse analysis systems may facilitate future integration between TPM qualitative pulse assessment and modern cardiovascular diagnostics by evaluating waveform morphology, rhythm variability, vascular elasticity, and hemodynamic patterns (Nafisi and Ghods 2021; Nafisi et al. 2022).

Nevertheless, current AI-assisted TPM pulse systems remain preliminary and require large-scale validation, reproducibility assessment, and standardized physiological correlation before clinical implementation can be recommended.

Components and parameters of the pulse

According to classical sources, each pulse cycle has two movements (expansion, contraction) and two rests (peripheral, central), interpreted in relation to physiological and energetic states (Vaghasloo et al. 2017b). TPM defines ten fundamental pulse parameters for assessment: 1) Expansion Dimensions (length, width, height), 2) Strength, 3) Speed, 4) Frequency, 5) Vessel Fullness, 6) Vessel Consistency, 7) Overlying Tissue Quality, 8) Uniformity, 9) Regularity, and 10) Pulse Weight ("Music"). These evaluate aspects from heart strength and vessel flexibility to arrhythmia patterns. Such multidimensional pulse assessment reflects TPM's holistic approach to cardiovascular evaluation, integrating vascular, hemodynamic, emotional, and constitutional factors simultaneously.

Methodology of pulse diagnosis

Pulse examination uses four fingers placed near the radial styloid process, each sensing different qualities like strength and rhythm (Vaghasloo et al. 2017b). Diagnosis considers contextual factors like season, time of day, patient temperament (*mizaj*), satiety, emotional state, and physical activity, as these influence pulse characteristics. This individualized approach resembles modern personalized medicine frameworks in which physiological measurements are interpreted alongside behavioral, environmental, and metabolic variables.

Modern Technological Integration

Modern technology integrates TPM pulse diagnosis through AI-assisted devices. Nafisi et al. (2021) developed a wrist-pulse sensor with convolutional neural networks to quantify TPM parameters like pace and elasticity. Their study successfully classified pulse features in participants, enhancing the objectivity and reliability of this traditional tool. This suggests digital sensors with machine learning can translate subjective TPM assessments into quantifiable metrics for integrative cardiology (Nafisi and Ghods 2021; Nafisi et al. 2022). Recent advances in wearable biosensors, digital health monitoring, and artificial intelligence further support the possibility of correlating TPM pulse characteristics with measurable cardiovascular parameters such as arterial stiffness, heart rate variability, autonomic balance, and vascular compliance (Muse and Topol 2024).

However, current evidence remains preliminary because most AI-assisted TPM pulse studies involve limited datasets, insufficient external validation, and heterogeneous methodologies. Consequently, larger multicenter investigations and standardized physiological benchmarks are required before these technologies can be integrated into routine cardiovascular practice.

Future developments may integrate wearable biosensors, cloud-based cardiovascular monitoring, and machine-learning algorithms capable of correlating TPM pulse patterns with arterial stiffness, endothelial dysfunction, heart rate variability, and autonomic imbalance. Such systems may facilitate longitudinal cardiovascular monitoring and personalized preventive cardiology. Nevertheless, these technologies remain investigational and require large multicenter validation studies before clinical implementation.

Relevance to integrative cardiology

While modern cardiology uses tools like Electrocardiogram (ECG) and echocardiography, TPM pulse diagnosis provides dynamic, holistic insights. AI-based pulse analysis with TPM parameters could complement cardiovascular risk stratification in preventive medicine (Nafisi et al. 2022; Vaghasloo et al. 2017b) (Figure 3). Such integrative approaches may be particularly valuable for preventive cardiology, remote patient monitoring, lifestyle-based interventions, and individualized cardiovascular risk assessment.

Heart–Mind axis and psycho-cardiology in traditional Persian medicine

In TPM, the heart-mind relationship is conceptualized through pneuma (*rūḥ*), a vital breath generated in the heart that carries both physical vitality and mental faculties when balanced in temperament (*mizaj*) (Bartoš and King 2020; Mosaddegh et al. 2013).

Pneuma mediates how emotions like fear, anger, joy, and grief influence cardiovascular function by affecting heart rhythm, vessel tone, and *hararat* distribution (Mosaddegh et al. 2013). Excessive emotional disturbance disrupts humoral equilibrium (*akhlaat*), paralleling modern psychocardiology where stress and mood disorders are risk factors for acute coronary syndrome, myocardial ischemia, and arrhythmias (Jiang et al. 2013; Sarebanhassanabadi et al. 2024). This convergence suggests that TPM psycho-cardiological concepts may represent early holistic observations of neuroendocrine, autonomic, and inflammatory cardiovascular interactions.

Modern medicine's heart-brain axis, mediated by neuroendocrine pathways and inflammatory mediators (Muse and Topol 2024), shows similar mechanisms—where mental stress triggers endothelial dysfunction and coronary vasoconstriction, analogous to TPM's impaired pneuma flow. Recent evidence additionally demonstrates

that chronic psychological stress contributes to autonomic imbalance, increased cortisol release, oxidative stress, platelet activation, and vascular inflammation, all of which substantially elevate cardiovascular risk (Kivimäki and Steptoe 2018).

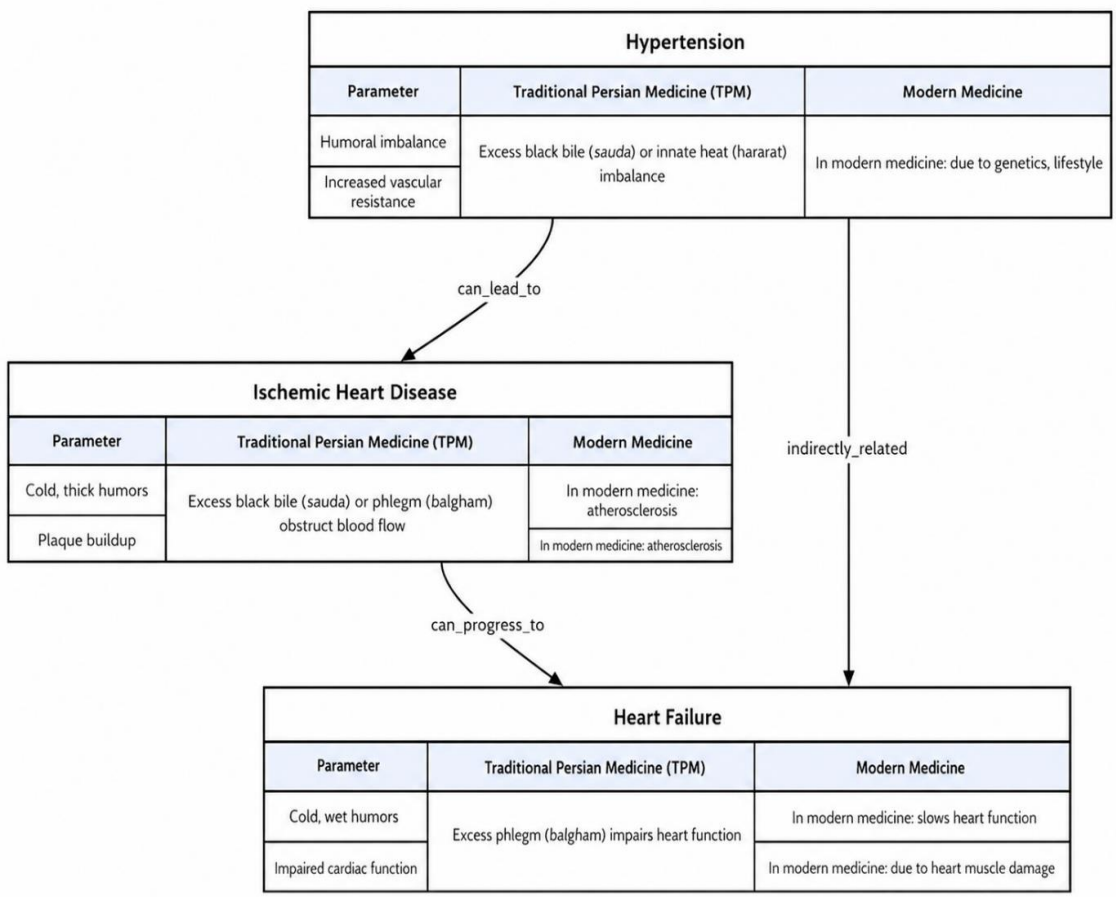

Figure 3. Overview of heart diseases in traditional Persian medicine (TPM) and modern cardiology

Hypertension (*Emtelaa*ˀ)

In TPM, hypertension (*emtelaa*ˀ) arises from humor excess (particularly black bile or phlegm) or *hararat* dysregulation, increasing vascular resistance (Hasani et al. 2020; Navabzadeh et al. 2020). Predisposing factors include rich/salty foods, sedentarism, and emotional stress. Symptoms include headaches, flushing, dizziness, and palpitations, with a hard, forceful pulse (Hasani et al. 2020).

Treatment emphasizes humoral rebalancing and lifestyle regulation:

- Dietary adjustments: Reduce salty/heavy meals; increase foods with cooling and diluting effects (Kordafshari et al. 2015).
- Herbal therapy: Garlic (*Allium sativum*), pomegranate (*Punica granatum*), and saffron (*Crocus sativus*) have hypotensive, antioxidant, and endothelial-protective effects (Abazari et al. 2024; Sobhani et al. 2017).
- Lifestyle: Emotional moderation, regular physical activity, and stress reduction to prevent recurrence humoral excess (Abolhosseini et al. 2021).

Several modern clinical and experimental studies support the antihypertensive and endothelial-protective effects of TPM-recommended interventions. Garlic supplementation has been associated with modest reductions in systolic and diastolic blood pressure through nitric oxide modulation and

antioxidant activity (Emamat et al. 2020), while saffron and pomegranate exhibit anti-inflammatory and vascular protective properties (Abazari et al. 2024; Marrone et al. 2024).

Nevertheless, findings across herbal intervention studies remain partially inconsistent due to variability in extraction methods, dosage protocols, study duration, and patient populations. Therefore, although TPM-based therapies show promising complementary potential, additional standardized randomized controlled trials are needed to establish definitive clinical efficacy.

Ischemic heart disease (IHD)

TPM attributes IHD to obstruction of pneuma and blood flow from cold, viscous humors impairing myocardial *hararat* delivery (Eram et al. 2023; Mosaddegh et al. 2013), corresponding to modern angina and infarction. These descriptions may functionally parallel modern concepts such as impaired coronary perfusion, endothelial dysfunction, vascular inflammation, and atherosclerotic obstruction. However, such correspondences should be interpreted cautiously as conceptual analogies rather than direct physiological equivalences. Prevention focuses on maintaining humoral balance through diet and activity while avoiding cold/damp exposure (Kordafshari et al. 2015). Treatment uses warming herbs like ginger and cinnamon to improve circulation (Maierean et al. 2017), and procedures like bloodletting (*fasd*) or cupping to relieve vascular load (Nimrouzi et al. 2014b). Modern pharmacological studies suggest that ginger (*Zingiber officinale*) and cinnamon (*Cinnamomum verum*) possess anti-inflammatory, antioxidant, vasodilatory, and metabolic regulatory properties that may contribute to endothelial protection and improved vascular function (Mandal and Kanthlal 2024; Naidu et al. 2025). Nevertheless, evidence regarding their direct clinical efficacy in ischemic heart disease remains limited and heterogeneous.

Heart failure (*Su᾽-e Mizaj Qalb*)

In TPM, heart failure represents a pathological temperament (*su᾽-e mizaj*) in which the heart's capacity to generate and distribute *hararat* is diminished, often due to an accumulation of cold and moist humors (Keihanian et al. 2023). This leads to sluggish metabolism, fluid retention, and reduced vitality—symptoms closely paralleling modern chronic heart failure. The TPM description of weakened cardiac vitality may partially overlap with modern observations regarding impaired myocardial contractility, neurohormonal dysregulation, mitochondrial dysfunction, and systemic congestion.

Management in TPM includes:

- Warming and cardiotonic herbs: Hawthorn (*Crataegus monogyna*), cinnamon, and saffron have been described to strengthen the heart and improve perfusion (Rastogi et al. 2016; Sobhani et al. 2017).
- Dietary support: Easily digestible, warming foods to enhance metabolic activity (Keihanian et al. 2023)
- Emotional care: Stress reduction to avoid further depletion of *hararat* (Mosaddegh et al. 2013)

Experimental and clinical studies suggest that hawthorn extracts may improve endothelial function, coronary circulation, exercise tolerance, and fatigue in some heart failure patients through flavonoid-mediated antioxidant and vasodilatory effects (Keihanian et al. 2023; Rastogi et al. 2016). However, current evidence remains insufficient for definitive therapeutic recommendations because of methodological variability and inconsistent trial outcomes.

The TPM framework for the heart–mind axis integrates emotional, metabolic, and circulatory health into a unified model. This aligns with emerging modern research on psychocardiology, heart–brain crosstalk, and the role of stress in cardiovascular disease. The convergence of these perspectives supports the development of

integrative prevention and treatment strategies for hypertension, IHD, and heart failure. Recent studies further demonstrate that chronic psychological stress contributes to autonomic imbalance, endothelial dysfunction, inflammatory activation, and adverse cardiovascular outcomes, thereby reinforcing the relevance of psycho-cardiological approaches in integrative care (Kivimäki and Steptoe 2018).

Therapeutic approaches in traditional Persian medicine (TPM) for cardiovascular health

In TPM, the management of cardiovascular diseases—particularly heart failure (*suʾ-e mizaj qalb*)—fundamentally aims at restoring humoral balance and supporting the heart's capacity to generate and distribute *hararat* (innate heat) (Keihanian et al. 2023; Mosaddegh et al. 2013). Warming and tonifying botanicals such as ginseng (*Panax ginseng*) and ashwagandha (*Withania somnifera*) are traditionally prescribed to strengthen cardiac function, improve vitality, and counteract cold–moist humoral dominance (Dasgupta et al. 2008). Dietary and lifestyle modifications—notably the avoidance of cold foods, excessive damp environments, and prolonged emotional distress—are considered crucial to preventing relapse (Abolhosseini et al. 2021; Kordafshari et al. 2015). Importantly, TPM therapeutic strategies often employ multi-target interventions simultaneously affecting metabolism, endothelial function, oxidative stress, autonomic regulation, and emotional balance. Such systems-oriented approaches may provide useful complementary perspectives for chronic multifactorial disorders such as cardiovascular disease.

Preventive measures in TPM for cardiovascular health

Prevention is a cornerstone of TPM, emphasizing the preservation of humoral equilibrium, optimal *hararat*, and the avoidance of factors that could precipitate vascular obstruction or myocardial weakness (Mosaddegh et al. 2013). Preventive recommendations are personalized according to the patient's *mizaj* (temperament) and include dietary regulation, physical activity, emotional balance, and seasonal adjustments (Table 1).

Table 1. Comparative Approach to Heart Disease in TPM and Conventional Medicine

Aspect	Traditional Persian Medicine (TPM)	Conventional Medicine
Understanding of hypertension	Imbalance of humors, particularly excess sauda (black bile), and *hararat* imbalance (Hasani et al. 2020)	Increased vascular resistance, genetic predisposition
Treatment of hypertension	Herbal remedies (garlic, saffron), dietary modifications, bloodletting (Sobhani et al. 2017)	Angiotensin-converting enzyme (ACE) inhibitors, beta-blockers, lifestyle changes
Ischemic heart disease (IHD)	Obstruction due to cold, thick humors (sauda or balgham) (Eram et al. 2023)	Atherosclerosis due to plaque buildup
Treatment of IHD	Warming herbs (ginger, cinnamon), phlebotomy, lifestyle adjustment (Maierean et al. 2017)	Statins, antiplatelets, angioplasty
Heart failure (*suʾ-e mizaj qalb*)	Weakening of the heart from cold–wet humoral excess (Keihanian et al. 2023)	Impaired contractility due to structural damage
Treatment of heart failure	Warming, tonifying herbs (ginseng, ashwagandha) (Dasgupta et al. 2008)	Diuretics, ACE inhibitors, beta-blockers
Preventive cardiology	Balanced diet, moderate exercise, emotional harmony (Kordafshari et al. 2015)	Risk factor management (lipid control, smoking cessation)
Diagnostics	Pulse diagnosis, humoral assessment (Mosaddegh et al. 2013)	Electrocardiogram (ECG), echocardiography, biomarkers

Diet and nutrition

TPM dietary guidance for cardiovascular health prioritizes foods that support *hararat* and humoral harmony. Warm and moist foods—such as lamb broth, whole grains, fresh fruits, and light herbal infusions—are preferred for individuals with cold or dry *mizaj* (Kordafshari et al. 2015). Conversely, cold and dry foods (e.g., cucumber, eggplant) are restricted to prevent humoral imbalance that may predispose to hypertension or ischemia (Hasani et al. 2020). Functional foods such as pomegranate (*Punica granatum*) are valued for their circulatory benefits, while honey is regarded as a cardiac tonic and vitality enhancer (Kamyab et al. 2021)—an insight supported by modern antioxidant research. Modern nutritional cardiology similarly emphasizes plant-rich diets, antioxidant intake, metabolic regulation, and reduction of chronic inflammation. The convergence between TPM dietary principles and Mediterranean-style preventive nutrition highlights the potential relevance of culturally adapted dietary interventions in cardiovascular prevention.

Physical activity

Moderate, regular exercise is prescribed in TPM to facilitate humoral clearance, enhance *hararat*, and improve circulation. Activities inducing mild perspiration—such as brisk walking, swimming, or light calisthenics—are recommended to prevent the accumulation of cold, viscous humors linked to heart failure and ischemia (Mosaddegh et al. 2013). TPM cautions against both extreme sedentarism and excessive exertion, advocating a personalized intensity based on *mizaj* and seasonal factors (Kordafshari et al. 2015). This individualized approach resembles current exercise-based cardiac rehabilitation models that tailor physical activity according to patient tolerance, cardiovascular risk, age, and metabolic status.

Stress management and emotional health

TPM accords major importance to emotional stability in cardiovascular prevention, noting that persistent anger, anxiety, grief, or fear disturb *hararat* and predispose one to conditions such as hypertension and khafaghan (palpitations) (Mosaddegh et al. 2013; Sarebanhassanabadi et al. 2024). Recommended practices include meditation, rhythmic breathing, poetry recitation, and immersion in natural environments, all aiming at restoring heart–mind balance.

Herbal remedies for prevention

TPM employs a diverse materia medica for cardiovascular prevention. Warming, circulatory-enhancing herbs—including ginger (Zingiber officinale), cinnamon (Cinnamomum verum), saffron (Crocus sativus), and garlic (Allium sativum)—are particularly valued for dissolving vascular obstructions, reducing viscosity, and preserving *hararat* (Maierean et al. 2017; Sobhani et al. 2017)(Table 2).

Table 2. Medicinal herbs for heart health in traditional Persian medicine (TPM) and conventional medicine

Herb (TPM Name)	Scientific Name	Common Name	Effects in TPM	Evidence-Based Effects in Conventional Medicine (2021–2025)	Common Side Effects	Drug Interactions	Typical Dosage	Key Literature
Seer	*Allium sativum*	Garlic	Balances *Hararat*, reduces hypertension, improves circulation	Antihypertensive, lipid-lowering, antiplatelet; meta-analyses show reduced systolic BP by ~5 mmHg	GI upset, halitosis	↑ bleeding risk with anticoagulants, antiplatelets	600–1200 mg/day extract or 2–5 g fresh	(Kamyab 2021; Avicenna)
Zafaran	*Crocus sativus*	Saffron	Reduces BP, improves mood, supports heart function	Antidepressant, antioxidant, mild BP reduction; cardioprotective in ischemia models	Nausea, dizziness	Potentiates antidepressants	30 mg/day	(Kordafshari 2015; Avicenna)

Table 2. Continued

Zanjabeel	*Zingiber officinale*	Ginger	Warming, improves circulation, reduces viscosity	Anti-inflammatory, antiplatelet, metabolic syndrome benefits	Heartburn, diarrhea	↑ bleeding risk with anticoagulants	1–2 g/day dried or 10–15 g fresh	(Maierean 2017; Avicenna)
Darchini	*Cinnamomum verum*	Cinnamon	Warming, improves heart strength, reduces viscosity	Lowers blood sugar, antioxidant, anti-inflammatory; emerging BP benefits	Allergy, possible hepatotoxicity (high dose)	Potentiates antidiabetics, hepatotoxic drugs	1–6 g/day powder	(Maierean 2017; Avicenna)
Baleelaj	*Terminalia chebula*	Chebulic Myroblan	Strengthens heart, digestion, balances humors	Antioxidant, anti-inflammatory, endothelial protective	Diarrhea, cramps	May interact with antidiabetics	500 mg–1 g/day extract	(Kamyab 2021; Avicenna)
Gule-Gawzaban	*Borago officinalis*	Borage	Calms heart, reduces stress, emotional balance	Anxiolytic, anti-inflammatory, mild diuretic	Hepatotoxicity (pyrrolizidine alkaloids)	↑ bleeding risk, CNS depressants	1–2 g/day dried herb	(Ghaffari 2013; Avicenna)
Gul-e-Yaas	*Salvia rosmarinus*	Rosemary	Strengthens heart, improves memory, supports circulation	Antioxidant, vasodilatory, cognitive enhancement	Allergy, seizure risk (high dose)	↑ bleeding risk	500 mg–1 g/day dried	(Kamyab 2021; Avicenna)
Asal	N/A	Honey	Strengthens heart, circulation, balances *Hararat*	Antioxidant, antimicrobial, wound healing; supports metabolic health	↑ blood sugar	Antidiabetics	1–2 tbsp/day	(Kordafshari 2015; Avicenna)
Gul-e-Surkh	*Rosa damascena*	Damask Rose	Supports heart, reduces anxiety, balances humors	Mild sedative, antioxidant, anti-inflammatory	Rare allergy	CNS depressants	1–2 g/day dried	(Ghaffari 2013; Avicenna)
Ravand	*Rheum emodi*	Rhubarb	Supports liver & heart, reduces *Sauda*	Laxative, antioxidant, hepatoprotective	GI upset	Diuretics, antihypertensives	500 mg–1 g/day dried	(Ghaffari 2013; Avicenna)
Ginseng	*Panax ginseng*	Ginseng	Strengthens heart, boosts vitality	Adaptogen, improves cardiac output, antioxidant	Insomnia, headache	Stimulants, anticoagulants	200–400 mg/day extract	(Dasgupta 2008; Avicenna)
Aamla	*Emblica officinalis*	Indian Gooseberry	Strengthens heart & liver, antioxidant	Hypolipidemic, antioxidant, anti-inflammatory	GI upset	Anticoagulants, antidiabetics	500 mg–1 g/day dried	(Dasgupta 2008; Avicenna)
Shaqaqul	*Peucedanum ostruthium*	Masterwort	Balances humors, supports heart & lungs	Antioxidant, anti-inflammatory	Rare allergy	Anticoagulants	500 mg–1 g/day dried root	(Kamyab 2021; Avicenna)
Reyhan	*Ocimum basilicum*	Basil	Calms heart, balances emotions, circulation	Antioxidant, anti-inflammatory, lipid-lowering	Rare allergy	Anticoagulants, antidiabetics	1–2 g/day	(Ghaffari 2013; Avicenna)
Ostokhodus	*Lavandula angustifolia*	Lavender	Calms heart, reduces anxiety	Sedative, antioxidant, anxiolytic	Allergy	CNS depressants	500 mg–1 g/day dried	(Kamyab 2021; Avicenna)
Hulbah	*Trigonella foenum-graecum*	Fenugreek	Strengthens heart, supports digestion	Hypoglycemic, hypolipidemic	GI upset	Antidiabetics	1–2 g/day seeds	(Ghaffari 2013; Avicenna)
Badranjboyeh	*Melissa officinalis*	Lemon Balm	Calms heart, supports sleep	Antioxidant, anxiolytic, mild sedative	Rare allergy	CNS depressants	1–2 g/day dried	(Ghaffari 2013; Avicenna)
Sumaq	*Rhus coriaria*	Sumac	Balances humors, anti-inflammatory	Antioxidant, hypolipidemic	GI discomfort	Antidiabetics, antihypertensives	1–2 g/day dried	(Ghaffari 2013; Avicenna)
Anjir	*Ficus carica*	Fig	Supports heart, improves digestion	Antioxidant, anti-inflammatory, gut health	GI discomfort	Antidiabetics	2–4/day fresh	(Kamyab 2021; Avicenna)
Sandal	*Santalum album*	Sandalwood	Cools heart, balances *Hararat*	Antioxidant, anti-inflammatory	Skin reactions	CNS depressants	500 mg–1 g/day dried bark	(Ghaffari 2013; Avicenna)

Several of these botanicals demonstrate antioxidant, anti-inflammatory, endothelial-protective, lipid-lowering, and metabolic regulatory effects in experimental and clinical studies (Abazari et al. 2024; Emamat et al. 2020). However, substantial heterogeneity persists regarding herbal formulation, extraction methods, dosage standardization, and long-term cardiovascular outcomes.

Bloodletting (*Fasd*)

Bloodletting is described in TPM as a preventive and therapeutic measure to reduce cardiovascular load by removing excess *sauda* and blood. When performed under proper indications—considering seasonal timing, patient temperament, and current vitality—, it is believed to relieve vascular tension, improve perfusion, and restore humoral equilibrium (Nimrouzi et al. 2014b). Modern parallels can be drawn with therapeutic phlebotomy in conditions like hemochromatosis and polycythemia. Nevertheless, contemporary evidence supporting bloodletting for routine cardiovascular prevention or treatment remains limited and controversial. Rigorous controlled clinical studies are required before such interventions can be recommended within evidence-based cardiovascular practice. Importantly, contemporary evidence supporting bloodletting for cardiovascular prevention remains insufficient, and inappropriate application may expose patients to anemia, infection, hypotension, or delayed evidence-based treatment.

Integrating TPM and modern preventive strategies

While modern cardiology emphasizes pathophysiological risk modification, TPM contributes to a temperament-based personalization that integrates physical, emotional, and seasonal variables into care planning (Abolhosseini et al. 2021). A combined model could merge pharmacological therapy, diagnostic imaging, and biomarker monitoring with TPM dietary and herbal protocols, seasonal exercise prescriptions, and pulse-based risk assessment. Such integrative frameworks may contribute to preventive, personalized, and lifestyle-oriented cardiovascular care. However, successful implementation requires standardized diagnostic criteria, mechanistic validation, safety assessment of herb–drug interactions, and robust randomized clinical trials evaluating long-term cardiovascular outcomes.

Modern perspectives and synergies

Modern cardiovascular medicine identifies mechanistic targets such as endothelial dysfunction, oxidative stress, and neurohormonal dysregulation (Muse and Topol 2024). When these are mapped against TPM concepts, such as impaired pneuma flow, loss of *hararat*, and humor thickening, there emerges a conceptual overlap that supports integrative research (Table 3.). Importantly, these correspondences should be regarded as interpretive and hypothesis-generating frameworks rather than direct physiological equivalences. Such comparative models may nevertheless facilitate interdisciplinary dialogue between traditional systems medicine and modern cardiovascular science.

Table 3. Comparative approach to heart health in traditional Persian medicine (TPM) and conventional medicine

Aspect	Traditional Persian Medicine (TPM)	Conventional Medicine	Integration Opportunities
Philosophical Foundation	Holistic paradigm emphasizing *mizaj* (temperament), *hararat* (innate heat), and humoral balance as determinants of cardiovascular health.	Reductionist biomedical framework focusing on measurable physiological parameters and molecular pathways.	Integrative models combining personalized temperament-based assessment with biomarker-driven risk stratification.
Role of the Heart	Central organ for generating and distributing *hararat*, maintaining humoral equilibrium, and supporting physical–emotional–spiritual well-being.	Mechanical pump responsible for systemic and pulmonary blood circulation.	Acknowledging psychosomatic influences on cardiovascular outcomes within evidence-based practice.
Heart Function	Integrates mechanical, metabolic, and emotional regulation of health; vitality linked to balanced *hararat*.	Determined by cardiac output, ejection fraction, and hemodynamic stability.	Combining functional imaging with temperament evaluation to personalize therapy.
Key Concepts	*Hararat*, *mizaj*, balance of *akhlaat* (humors).	Blood pressure, cardiac output, vascular resistance, endothelial health.	Cross-referencing *mizaj* patterns with cardiovascular phenotypes (e.g., hypertensive phenotypes).
Health Maintenance	Diet, seasonal lifestyle regulation, emotional balance, moderation in physical exertion.	Balanced diet, physical activity, stress management, sleep hygiene.	Integrating seasonal TPM diet–lifestyle recommendations with WHO cardiovascular prevention guidelines.
Preventive Measures	Adjusting diet and habits to temperament, avoiding extreme emotions, maintaining humoral balance.	Control of modifiable risk factors: hypertension, dyslipidemia, smoking, diabetes.	Blending TPM preventive advice with modern risk-factor scoring tools (e.g., SCORE2, ASCVD calculator).
Diagnostic Methods	Pulse diagnosis, temperament analysis, observation of physical/emotional signs.	Blood tests, ECG, echocardiography, cardiac MRI, wearable devices.	Studying correlations between pulse diagnosis parameters and hemodynamic/ECG findings.
Role of Emotions	Core determinant; excessive anger, grief, or anxiety believed to disrupt *hararat* and humoral balance.	Psychological stress recognized as a cardiovascular risk factor via autonomic and inflammatory pathways.	Integrative mind–body interventions combining meditation, herbal anxiolytics, and CBT.
Dietary Recommendations	Food prescribed based on *mizaj*; warm–moist foods favored for cold/dry temperaments.	Balanced diet, low in saturated fat, high in fruits/vegetables (DASH, Mediterranean diets).	Comparing TPM diet prescriptions with Mediterranean/DASH outcomes in clinical trials.
Physical Activity	Exercises selected to balance humors, enhance *hararat*, and avoid overexertion.	Regular moderate-to-vigorous aerobic activity (150 min/week).	Tailoring exercise type and intensity to temperament profiles while maintaining modern activity targets.
Stress Management	Meditation, controlled breathing, spiritual reflection, nature immersion.	Psychotherapy, stress-reduction programs, relaxation techniques.	Integrating TPM relaxation practices with structured cardiac rehabilitation programs.
Pharmacological Interventions	Herbal remedies to restore humoral balance and optimize *hararat*.	Targeted drugs (antihypertensives, statins, antiplatelets, beta-blockers, anticoagulants).	Evaluating safety and efficacy of TPM herbal agents in adjunct to conventional drugs through clinical trials.

Hypertension Pathophysiology

Hypertension is a complex, multifactorial condition driven by interactions between genetic susceptibility, high sodium diets, sedentary behavior, stress, and environmental exposures (WHO 2025). It manifests as sustained arterial pressure elevation due to increased systemic vascular resistance, endothelial dysfunction, and neurohormonal activation, including overactivity of the renin–angiotensin–aldosterone system and heightened sympathetic tone (Goel et al. 2022). Persistent hypertension causes structural vascular changes and left ventricular hypertrophy, and accelerates atherosclerotic progression.

Treatment modalities

Current guidelines recommend stepwise pharmacologic therapy—ACE inhibitors, ARBs, beta-blockers, calcium channel blockers, diuretics—alongside lifestyle optimization (salt restriction, weight reduction, aerobic activity, alcohol moderation). TPM-based integration adds a dietary and herbal dimension: Allium sativum (garlic) improves vascular elasticity and nitric oxide bioavailability (Emamat et al. 2020), while Crocus sativus (saffron) exerts vasodilatory, antioxidant,

and mood-enhancing effects (Marrone et al. 2024). These botanicals are traditionally employed to correct humoral imbalance, particularly excess *sauda*, and maintain *hararat* equilibrium (Table 4). Although several studies report favorable antihypertensive and endothelial-protective effects for TPM-derived botanicals, findings remain partially inconsistent because of differences in extraction methods, dosage protocols, patient populations, and study duration. Therefore, further standardized randomized clinical trials are required before definitive therapeutic recommendations can be established.

Table 4. Mechanistic Summary of Selected TPM-based Interventions in Cardiovascular Health

TPM Intervention	Modern Pharmacological Target	Mechanism of Action	Clinical/Preclinical Evidence	Reference(s)
Garlic (Allium sativum)	RAAS inhibition, NO pathway	Inhibits ACE activity, enhances endothelial NO production, reduces LDL oxidation	RCTs show BP reduction in mild–moderate hypertension	Emamat et al., 2020
Pomegranate (Punica granatum)	Endothelial protection, anti-inflammatory	Polyphenols suppress NF-κB, increase eNOS activity, reduce CRP	Clinical trials demonstrate improved flow-mediated dilation	Abazari et al., 2024
Cinnamon (Cinnamomum verum)	Lipid metabolism, insulin sensitivity	Reduces lipid peroxidation, improves glucose uptake, lowers serum triglycerides	Meta-analysis shows improved lipid profile	Fateh & Amin, 2024
Saffron (Crocus sativus)	Microcirculation, antioxidant defense	Crocetin increases eNOS, reduces ROS, modulates calcium signaling	Preclinical models show reduced ischemia-reperfusion injury	Marrone et al., 2024
Hawthorn (Crataegus monogyna)	Calcium handling in cardiomyocytes	Flavonoids stabilize sarcoplasmic reticulum calcium release, improve contractility	Human studies report improved CHF symptoms	Rastogi et al., 2016; Keihanian et al., 2023
Quince (Cydonia oblonga)	Vascular smooth muscle tone	Triterpenes inhibit VSMC proliferation, improve arterial compliance	Animal studies show hypotensive effects	Baharvand-Ahmadi et al., 2016
Fig (Ficus carica)	Glycemic control, antioxidant	Polyphenols reduce oxidative stress, improve insulin sensitivity	Limited clinical data suggest lipid-lowering effects	Abazari et al., 2024
Borage (Borago officinalis)	GABAergic neurotransmission	Gamma-linolenic acid modulates CNS excitability, reduces stress-induced hypertension	TPM use for stress-related cardiac symptoms supported by phytochemical data	Zarshenas et al., 2016
Mind–body practices (deep breathing, meditation)	Autonomic balance	Increases parasympathetic tone, reduces cortisol, lowers heart rate variability indices of stress	Mindfulness-based interventions improve QoL in CVD	Momeni et al., 2018
Salt moderation & *mizaj*-adjusted diet	BP regulation, electrolyte balance	Reduces sodium load, optimizes potassium–sodium ratio, improves vascular reactivity	TPM dietary trials show BP improvement in pre-hypertension	Abolhosseini et al., 2021

Cardiopulmonary Disorders Understanding and Treatment

Cardiopulmonary disorders such as chronic obstructive pulmonary disease (COPD) and heart failure (HF) represent leading causes of disability and mortality worldwide (Boers et al. 2023). They are characterized by impaired gas exchange, systemic inflammation, and reduced cardiac output, often coexisting and compounding morbidity. Standard management includes bronchodilators, anti-inflammatory agents, diuretics, RAAS inhibitors, and device therapy, with surgical options reserved for advanced disease.

Integration with TPM

In TPM, cardiopulmonary health hinges on optimal circulation of *hararat* and balance among the four humors. Warming herbs—Zingiber officinale (ginger) and Cinnamomum verum (cinnamon)—are prescribed to enhance circulation, reduce congestion, and counteract cold humors implicated in HF and COPD. Modern trials report ginger's bronchodilatory, anti-inflammatory and antiplatelet effects

(Gupta et al. 2025), and cinnamon's glucose- and lipid-lowering benefits (Fateh and Amin 2024), which may indirectly support cardiopulmonary function. Adjunctive TPM regimens could help optimize symptom control and quality of life when combined with standard pharmacotherapy. Nevertheless, direct evidence supporting TPM interventions in COPD and advanced heart failure remains limited, and careful evaluation of herb–drug interactions is essential, particularly in patients receiving anticoagulants, antiarrhythmics, or multiple cardiovascular medications.

Preventive cardiology

Role of prevention

Modern preventive cardiology focuses on aggressive risk factor modification: controlling blood pressure, lipids, and glucose; encouraging smoking cessation; and promoting physical activity. Digital tools like the Green Heart mobile application enable personalized monitoring and coaching, leading to better adherence and outcomes (Ghavami et al. 2024).

Integration with TPM

TPM preventive principles—dietary regulation, physical activity tailored to temperament (*mizaj*), seasonal adaptation, and emotional hygiene—are fully compatible with modern preventive strategies. Warm–moist diets are recommended for cold–dry temperaments, while activities promoting moderate sweating are favored to clear excess humors. This approach adds individualized personalization absent in one-size-fits-all modern guidelines. This personalized orientation of TPM conceptually resembles emerging precision and lifestyle medicine approaches that integrate behavioral, metabolic, environmental, and psychosocial factors into individualized cardiovascular prevention programs.

Research and evidence

Narrative reviews and emerging trials suggest that herbal supplementation (garlic, saffron) combined with TPM-inspired stress management may enhance conventional prevention outcomes (Kordafshari et al. 2015). These integrative models require rigorous evaluation through long-term cohort and interventional studies to determine sustained cardiovascular benefits. Future studies should additionally investigate whether TPM temperament categories (*mizaj*) correlate with measurable biomarkers such as inflammatory profiles, autonomic activity, endothelial responsiveness, metabolomic signatures, or cardiovascular risk stratification indices.

Heart–mind axis and psycho-cardiology

Psycho-cardiology

This emerging field investigates the reciprocal influence of psychological factors on cardiovascular disease development and progression. Chronic stress, anxiety, and depression elevate catecholamines and cortisol, impair endothelial function, and accelerate atherosclerosis (Kivimäki and Steptoe 2018).

Psychological factors and cardiovascular disease

Emotional instability can reduce coronary blood flow in stenotic arteries, exacerbating ischemia. Stress-induced immune dysregulation increases vulnerability to plaque rupture, precipitating acute coronary events (Chee et al. 2025; Shi et al. 2025). Recent evidence further demonstrates that chronic psychological stress contributes to autonomic dysregulation, inflammatory activation, oxidative stress, platelet activation, and endothelial injury, thereby substantially increasing long-term cardiovascular risk (Kivimäki and Steptoe 2018).

TPM perspective

In TPM, emotional health is integral to cardiac function. Excessive anger, grief, or fear is viewed as a cause of *hararat* imbalance and humoral disturbance, leading to palpitations (khafaghan), hypertension, or ischemia. Calming botanicals like Valeriana officinalis (valerian) and Borago officinalis (borage) are prescribed to reduce the hyperactivity of the nervous system and stabilize emotional states (Larit and León 2023; Mineo et al. 2017; Polimati et al. 2023). These TPM psycho-cardiological concepts may represent early holistic observations of the interactions between emotional stress, autonomic regulation, vascular function, and cardiovascular health.

Integration in modern practice

Pairing TPM emotional-balancing interventions with modern strategies such as cognitive behavioral therapy (CBT), mindfulness-based stress reduction (MBSR), and biofeedback could improve both mental resilience and cardiovascular outcomes (Momeni et al. 2018). This combined model reflects a holistic psycho-cardiology framework, integrating physiological, psychological, and traditional perspectives for more comprehensive care. However, the clinical efficacy of many TPM-based emotional interventions remains insufficiently studied in large cardiovascular populations, highlighting the need for robust interdisciplinary clinical trials evaluating both psychological and cardiovascular endpoints.

Discussion

Traditional Persian medicine and modern cardiology: A converging landscape

Traditional Persian Medicine (TPM) and modern cardiology show converging perspectives despite different theoretical frameworks. While TPM emphasizes humoral balance, *hararat* (innate heat), and *mizaj* (temperament), its clinical observations parallel modern cardiovascular pathophysiology, with both systems valuing vascular health and inflammation modulation (Boulant 2000; Vaghasloo et al. 2017a). TPM's view of the heart as both physical pump and psycho-spiritual center, noted by Avicenna (Chamsi-Pasha and Chamsi-Pasha 2014; Mosaddegh et al. 2013), finds validation in contemporary research. Mitochondrial energetics and cellular thermoregulation may provide partial functional parallels to the TPM concept of *hararat* (El-Gammal et al. 2022; Evans et al. 2015), and its dysregulation through oxidative stress can precipitate heart disease (Kruglov et al. 2023; Schirrmacher 2020). Importantly, this review does not propose that TPM concepts are direct biomedical equivalents of modern physiological mechanisms. Rather, these conceptual parallels are intended to provide interpretive frameworks that may facilitate interdisciplinary dialogue and translational hypothesis generation.

Interpreting TPM theories within modern cardiovascular science

TPM theories emerge from a holistic cosmological framework distinct from reductionist biomedicine. Therefore, concepts such as *mizaj* and *hararat* should not be interpreted as direct physiological entities. Nevertheless, their functional descriptions overlap with modern observations regarding metabolism, autonomic regulation, vascular tone, inflammatory balance, and endothelial function. These parallels are intended as interpretive and hypothesis-generating frameworks rather than literal physiological equivalences.

Regenerative strategies and cardiovascular repair

Regenerative medicine techniques—including stem cells, exosome signaling, and cardiac scaffolds—aim to replace damaged myocardium (Okhovatian et al.

2024), paralleling TPM's goal of enhancing intrinsic repair by restoring humoral balance and supporting *hararat*. TPM botanicals like ginger, saffron, and hawthorn show regenerative potential through various pathways: ginger reduces oxidative stress (Gupta et al. 2025; Naidu et al. 2025), saffron enhances eNOS activity (Marrone et al. 2024), and hawthorn stabilizes contractility (Keihanian et al. 2023; Rastogi et al. 2016).

Mitochondrial integrity, crucial for regeneration (El-Gammal et al. 2022; Münch and Harper 2016), aligns with TPM's emphasis on protecting innate heat, suggesting combined botanical and technological approaches could optimize post-infarction recovery. However, despite promising experimental findings, direct evidence supporting TPM-based regenerative cardiovascular therapies remains limited. Most available studies are preclinical, involve small populations, or lack standardized intervention protocols. Consequently, large-scale mechanistic and translational studies are necessary before definitive regenerative applications can be established.

Hypertension: Mechanistic and integrative perspectives

Hypertension remains a major modifiable CVD risk factor worldwide (Hasani et al. 2020; Sarebanhassanabadi et al. 2024). Modern pathophysiology focuses on RAAS, endothelial NO bioavailability, and sympathetic activation, while TPM indirectly targets these pathways by correcting humoral excess and modifying *mizaj* through diet, activity, and botanicals. Garlic inhibits ACE and enhances NO release (Emamat et al. 2020), cinnamon reduces lipid peroxidation, (Fateh and Amin 2024), and pomegranate (Punica granatum) protects endothelial integrity (Abazari et al. 2024).

TPM lifestyle interventions—salt moderation, fresh fruit intake, and sleep balance—can integrate with digital tools like the Green Heart application for personalized management, demonstrating a hybrid care model combining ancient principles with modern technology (Ghavami et al. 2024). The convergence between TPM preventive principles and modern lifestyle medicine is particularly notable in the domains of nutrition, stress management, individualized care, and behavioral modification. Such overlap supports the possibility of culturally adaptable integrative cardiovascular prevention models.

Cardiopulmonary disorders and endothelial protection

TPM's view of cardiopulmonary diseases often attributes pathology to a weakening of innate heat and accumulation of harmful humors, particularly phlegm and black bile. In chronic heart failure, this manifests as reduced contractile force (*quwa*) and impaired circulation (Akbari et al. 2022; Keihanian et al. 2023). Modern research similarly emphasizes vascular inflammation and endothelial injury in these pathologies (Chee et al. 2025; Faro et al. 2024).

Traditional botanicals such as quince, olive leaf extract, and fig contain polyphenols and triterpenes that inhibit vascular smooth muscle proliferation, reduce C-reactive protein levels, and improve arterial compliance (Baharvand-Ahmadi et al. 2016; Dehghani et al. 2023). This endothelial support complements modern pharmacological regimens targeting neurohormonal pathways. Nevertheless, current evidence regarding many TPM botanicals remains heterogeneous because of differences in extraction methods, phytochemical composition, dosage standardization, and study design. These limitations currently restrict reproducibility and broad clinical implementation.

Psycho-cardiology and the humoral–neuroendocrine interface

Both TPM and modern psycho-cardiology recognize stress as a potent

driver of cardiovascular disease (Kivimäki and Steptoe 2018). TPM identifies emotional disequilibrium—anger, grief, excessive worry—as disruptors of humoral stability, particularly *sauda*, leading to vascular constriction and ischemia (Ghaffari et al. 2022; Mosaddegh et al. 2013).

Modern evidence links chronic stress to dysregulated hypothalamic–pituitary–adrenal (HPA) axis activity, elevated cortisol, and increased inflammatory cytokines, accelerating atherosclerotic plaque development (Jiang et al. 2013). Mind–body interventions—mindfulness-based stress reduction (Momeni et al. 2018), cognitive behavioral therapy, and controlled breathing—mirror TPM's recommendations for mental balance and moderated social interaction. Botanicals such as valerian and borage act on GABAergic neurotransmission, reducing anxiety and indirectly lowering cardiovascular load (Kamyab et al. 2021; Zarshenas et al. 2016). Recent evidence further demonstrates that chronic psychological stress contributes to endothelial dysfunction, autonomic imbalance, platelet activation, and inflammatory dysregulation, thereby reinforcing the relevance of psycho-cardiological approaches in cardiovascular prevention and rehabilitation (Kivimäki and Steptoe 2018).

Personalized medicine: Integrating genomics with *mizaj*

The shift toward personalized medicine in cardiology—leveraging polygenic risk scores and pharmacogenomics—offers parallels with TPM's individualized temperament-based care (Akhtari et al. 2020; Itrat and Zulkifle 2014). For example, a patient genetically predisposed to hypercholesterolemia might benefit from both statin therapy and *mizaj*-tailored dietary adjustments, including pomegranate and garlic to enhance lipid clearance (Abazari et al. 2024; Li et al. 2015).

Integrating genetic profiling with TPM diagnostics could enable more precise primary prevention strategies, potentially improving predictive model performance for at-risk populations (van Daalen et al., 2024). Future interdisciplinary research should investigate whether TPM temperament categories correlate with measurable biomarkers such as metabolomic signatures, endothelial responsiveness, inflammatory mediators, autonomic regulation, or genomic susceptibility profiles. Such investigations may help operationalize TPM concepts within precision cardiovascular medicine frameworks.

This review has several limitations. The inclusion of historical TPM sources and preclinical studies alongside modern clinical trials creates heterogeneity and limits direct comparability. Much TPM evidence relies on observational data or in vitro/in vivo studies, requiring validation by large-scale randomized controlled trials. The lack of standardized dosages and preparations for herbal interventions complicates reproducibility. Finally, potential herb-drug interactions, though noted in traditional texts, remain underexplored in modern cardiovascular pharmacology, warranting caution and further investigation. The broad interdisciplinary scope of this review—including herbal medicine, psycho-cardiology, regenerative medicine, artificial intelligence, and preventive cardiology—may limit the depth of discussion in some specialized domains. AI-assisted pulse analysis and digital TPM applications, although promising, remain exploratory and currently lack sufficient large-scale validation studies. Additionally, TPM concepts originate from a historical holistic medical paradigm that differs fundamentally from modern reductionist biomedical frameworks; therefore, direct physiological equivalence between traditional and modern concepts cannot always be established.

The integration of Traditional Persian Medicine concepts—including *hararat*, humoral balance, and temperament-based guidance—with modern cardiology offers a promising path for holistic cardiovascular strategies. Evidence from both historical texts and contemporary studies supports the cardioprotective potential of TPM interventions, such as medicinal plants (garlic, saffron, pomegranate, hawthorn) and lifestyle modifications (stress reduction, tailored exercise, diet). Modern technologies like AI-powered tools, regenerative medicine, and genetic profiling provide synergistic opportunities to refine and personalize these approaches. While TPM and conventional medicine have different philosophical foundations, they share an emphasis on prevention and individualized care. Future research should prioritize rigorous clinical trials, standardized herbal preparations, and integrative models to fully realize the potential of combining TPM wisdom with modern science for improving patient outcomes. Overall, this review suggests that TPM may provide valuable complementary perspectives for preventive, personalized, and lifestyle-oriented cardiovascular medicine. Nevertheless, integration into evidence-based clinical practice requires robust mechanistic studies, standardized diagnostic criteria, careful evaluation of herb–drug interactions, and multicenter randomized clinical trials assessing long-term cardiovascular outcomes.

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Conceptualization and Supervision: M. Nimrouzi; Investigation and Data Curation: A. Ziaee and B. Aleali Harouni; Validation and Resources: M. Mohammadian; Writing – Original Draft Preparation: M. Nimrouzi, A. Ziaee and B. Aleali Harouni; Writing – Review & Editing: M. Nimrouzi, A. Ziaee, and M. Mohammadian. All authors read and approved the final manuscript.

Abbreviations

ACE: Angiotensin-converting enzyme
AI: Artificial intelligence
BP: Blood pressure
CBT: Cognitive behavioral therapy
COPD: Chronic obstructive pulmonary disease
CVD: Cardiovascular disease
ECG: Electrocardiogram
eNOS: Endothelial nitric oxide synthase
HF: Heart failure
HPA: Hypothalamic-pituitary-adrenal
IHD: Ischemic heart disease
LDL-C: Low-density lipoprotein cholesterol
MBSR: Mindfulness-based stress reduction
RAAS: Renin-angiotensin-aldosterone system
TPM: Traditional Persian Medicine
WHO: World Health Organization

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