

# Amalaki as a Natural Cardioprotective Agent: Insights from Ayurveda and Modern Medicine

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## ABSTRACT

Cardiovascular Diseases (CVDs) are a leading cause of global morbidity and mortality, necessitating innovative therapeutic approaches. Traditional medicinal systems, particularly Ayurveda, emphasize natural remedies, with *Emblica officinalis* (Amalaki or Indian gooseberry) gaining recognition for its cardioprotective properties. This study synthesizes Ayurvedic wisdom and modern scientific research to explore Amalaki's potential in cardiovascular health management. Rich in vitamin C, polyphenols, flavonoids, and tannins, Amalaki exhibits antioxidant, anti-inflammatory, lipid-lowering, and endothelial-protective effects. Preclinical and clinical studies suggest its role in reducing oxidative stress, modulating lipid metabolism, lowering hypertension, and preventing atherosclerosis. Amalaki's traditional use as a Rasayana (rejuvenator) and Hridya (heart tonic) aligns with its scientifically validated benefits, highlighting its potential as a holistic cardioprotective agent. While promising, further large-scale clinical trials are necessary to confirm its efficacy and establish standardized formulations for therapeutic applications. This review bridges traditional and contemporary perspectives, reinforcing Amalaki's relevance in cardiovascular disease prevention and management.

**Keywords:** *Emblica officinalis*, Amalaki, Indian Gooseberry, Cardiovascular Health, Cardioprotective, Ayurveda, Antioxidants, Lipid Metabolism, Hypertension, Atherosclerosis, Traditional Medicine.

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## INTRODUCTION

Cardiovascular Diseases (CVDs) remain a leading cause of morbidity and mortality worldwide, accounting for a significant proportion of global health burdens. Despite advancements in modern medicine, the rising prevalence of CVDs underscores the need for innovative and sustainable therapeutic strategies. In this context, natural products derived from traditional medicinal systems, such as Ayurveda, have gained renewed attention for their potential in preventing and managing chronic diseases. *Emblica*

*officinalis*, commonly known as Amalaki or Indian gooseberry, stands out as a cornerstone of Ayurvedic medicine, revered for its multifaceted health benefits, particularly its cardioprotective properties (Khurana *et al.*, 2019; Hussain *et al.*, 2021). Amalaki has been traditionally classified as a Rasayana (rejuvenator) and Hridya (cardioprotective) herb, with its use documented in ancient texts like the Charaka Samhita and Sushruta Samhita. Modern scientific research has begun to validate these traditional claims, revealing Amalaki's rich phytochemical profile, including high levels of vitamin C, polyphenols, flavonoids, and tannins, which contribute to its antioxidant, anti-inflammatory, lipid-lowering, and endothelial-protective effects (Purewal *et al.*, 2022; Purewal *et al.*, 2022). This paper aims to bridge the gap between Ayurvedic wisdom and contemporary medical science by synthesizing insights from both domains, exploring Amalaki's potential as a natural cardioprotective agent. Table 1 show plant taxonomic Classification.



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## METHODOLOGY

In order to conduct this comprehensive review on *Amalaki* (*Emblica officinalis*) as a Natural Cardioprotective Agent: Insights from Ayurveda and Modern Medicine, we gathered relevant data from credible and well-established sources, including PubMed, Scopus, ScienceDirect, Google Scholar, Web of Science, ResearchGate, and SciFinder. Our search focused on studies related to the ethnomedical applications, phytochemistry, pharmacological activities, and clinical significance of *Amalaki* in cardiovascular health. We analyzed research articles, systematic reviews, meta-analyses, and Randomized Controlled Trials (RCTs) published before March 2025. Additionally, classical Ayurvedic texts and pharmacopeial references were consulted to incorporate traditional perspectives. To ensure taxonomic accuracy, botanical names and plant classifications were verified using the Kew Royal Botanic Gardens and The Plant List. The keywords used for our search included *Emblica officinalis*, *Phyllanthus emblica*, *cardioprotective effects of Amalaki*, *Ayurvedic cardiology*, and *phytochemicals in Amalaki*, without any specific time restrictions to ensure a comprehensive collection of data.

### Amalaki in Ayurvedic Tradition

*Amalaki* (*Emblica officinalis*), revered as "Dhatri" (the nurse) and "Amalaki" in Ayurveda, holds a sacred position in India's ancient medicinal system as a symbol of vitality and longevity. Rooted in texts dating back over 3,000 years, *Amalaki* is celebrated not only as a fruit but as a Rasayana a rejuvenating herb that nourishes tissues (Dhatus), enhances immunity, and promotes holistic health. Classical Ayurvedic treatises such as the Charaka Samhita and Sushruta Samhita extol *Amalaki*'s unique ability to balance the three doshas (Vata, Pitta, and Kapha), with a pronounced emphasis on its Hridya (heart-friendly) and Medohara (fat-metabolizing) properties. According to Ayurvedic pharmacology (Dravyaguna), *Amalaki*'s Rasa (taste) is predominantly sour (*Amalaki*), yet it uniquely encompasses five of the six tastes (Shadrasa), lacking only saltiness (Lavana). This complexity underpins its versatility in addressing diverse physiological imbalances. Its Guna (qualities) include lightness (Laghu) and dryness (Ruksha), while its Virya (potency) is cooling (Shita), making it particularly effective in pacifying Pitta-related disorders such as inflammation and oxidative stress, which are closely linked to cardiovascular pathologies (Dasaroju and Gottumukkala, 2014). *Amalaki*'s role in cardiovascular health is further elucidated through its Vipaka (post-digestive effect), which is sweet (Madhura), aiding in stabilizing blood sugar and lipid metabolism a critical factor in preventing atherosclerosis. Traditional formulations like Chyawanprash (a herbal jam with *Amalaki* as the primary ingredient) and Triphala (a tri-herbal blend of *Amalaki*, Haritaki, and Bibhitaki) have been prescribed for centuries to enhance cardiac function, improve circulation, and detoxify blood (Rakta Shodhana). Ayurveda attributes heart

disease to imbalances in Sadhaka Pitta (governing emotional and cardiac function) and Avalambaka Kapha (regulating structural integrity of the heart). *Amalaki*'s ability to harmonize these sub-doshas while reducing Ama (metabolic toxins) and strengthening Ojas (vital essence) positions it as a cornerstone of heart health in Ayurvedic practice. This ancient wisdom, now increasingly corroborated by modern science, underscores *Amalaki*'s timeless relevance as a natural cardioprotective agent, bridging millennia-old insights with contemporary therapeutic needs (Mirunalini *et al.*, 2013).

### Phytochemistry of Amalaki (*Phyllanthus emblica*)

"*Amalaki*, or Indian gooseberry, is renowned for its rich phytochemical composition, which contributes to its diverse medicinal properties. The fruit is particularly valued for its high content of vitamin C, containing about 470-680 mg per 100 g of edible fruit, making it one of the richest sources of this vitamin. The major phytochemical constituents of *Amalaki* include tannins such as emblicanin A and B, punigluconin, pedunculagin, and geraniin, which are known for their antioxidant properties (Singh *et al.*, 2012). Phenolic acids like gallic acid and ellagic acid are also present, with gallic acid exhibiting antimicrobial activities and ellagic acid possessing anticancer properties. Flavonoids such as quercetin and kaempferol contribute to the plant's anti-inflammatory and antioxidant activities are shown in Tables 2 and 3. Additionally, *Amalaki* contains alkaloids like phyllantine and phyllantidine, as well as terpenoids and other compounds including fixed oils, phosphatides, and essential oils. The plant is also a good source of minerals like chromium, zinc, and copper, and contains amino acids such as glutamic acid, proline, aspartic acid, alanine, and lysine" (Khurana *et al.*, 2019).

*Amalaki*'s traditional and medicinal uses are extensive, "leveraging its adaptogenic properties to enhance immunity and balance bodily humors according to Ayurvedic principles. It is used as a diuretic, laxative, liver tonic, and restorative, treating conditions like diarrhea, jaundice, and fever. The antioxidant and anti-inflammatory activities of *Amalaki* make it beneficial for treating various health conditions. Furthermore, extracts of *Amalaki* have been studied for their antimicrobial, antidiabetic, and hepatoprotective effects, highlighting its potential in modern medicine". Overall, the phytochemical composition of *Amalaki* makes it a valuable resource in both traditional and modern healthcare systems shown in Figure 1, offering a wide range of health benefits (Patel and Goyal, 2012).

### Cardioprotective Effects of Amalaki: Ayurvedic and Modern Perspectives

*Amalaki*'s cardioprotective properties are deeply rooted in both Ayurvedic philosophy and modern scientific research. Its multifaceted mechanisms of action address key pathways involved in cardiovascular health, making it a potent natural agent for preventing and managing heart diseases. Below, we explore these

mechanisms in detail, integrating traditional Ayurvedic insights with contemporary scientific evidence.

### Antioxidant Mechanisms

“Oxidative stress, characterized by an imbalance between free radicals and antioxidants, is a major contributor to cardiovascular diseases, particularly atherosclerosis”. Amalaki’s high concentration of vitamin C, polyphenols, and flavonoids endows it with exceptional free radical scavenging capabilities. In Ayurveda, this aligns with its Rasayana properties, which combat Dhatu Kshaya (tissue degeneration) and Jara (aging). Modern studies have demonstrated that Amalaki reduces lipid peroxidation, “enhances the activity of endogenous antioxidant enzymes like Superoxide Dismutase (SOD) and Glutathione Peroxidase (GPx), and protects against oxidative damage to cardiac tissues. By neutralizing Reactive Oxygen Species (ROS) and reducing oxidative stress, Amalaki helps prevent endothelial dysfunction and the formation of atherosclerotic plaques”, thereby safeguarding cardiovascular health.

### Lipid Metabolism and Anti-Atherogenic Effects

Amalaki’s ability to modulate lipid metabolism is a cornerstone of its cardioprotective action. In Ayurveda, this is described as its *Medohara* (fat-reducing) property, which helps balance *Kapha* and prevent *Meda Dhatu* (adipose tissue) accumulation. Modern research corroborates this, showing that Amalaki significantly reduces total cholesterol, “low-density Lipoprotein (LDL), and triglycerides while increasing High-Density Lipoprotein (HDL). These effects are attributed to its bioactive compounds, such as ellagic acid and gallic acid, which inhibit cholesterol synthesis and enhance bile acid excretion. By preventing lipid accumulation in arterial walls, Amalaki reduces the risk of atherosclerosis and coronary artery disease”, aligning Ayurvedic wisdom with contemporary lipid-lowering strategies (Kumar *et al.*, 2017).

### Anti-Hypertensive Properties

Hypertension is a critical risk factor for cardiovascular diseases, and Amalaki’s anti-hypertensive effects are well-documented in both traditional and modern contexts. Ayurveda describes Amalaki as a *Pitta Shamaka* (Pitta-pacifying) herb, which helps regulate blood pressure by cooling and calming the body. “Modern studies reveal that Amalaki induces vasodilation by enhancing Nitric Oxide (NO) production and inhibiting Angiotensin-Converting Enzyme (ACE), a key regulator of blood pressure. Additionally, its potassium content helps balance sodium levels, further supporting healthy blood pressure. These mechanisms collectively contribute to Amalaki’s efficacy in managing hypertension and reducing the risk of associated cardiovascular complications” (Brown *et al.*, 2023).

### Anti-Inflammatory Actions

“Chronic inflammation is a hallmark of cardiovascular diseases, contributing to endothelial dysfunction, plaque formation, and myocardial damage. Amalaki’s anti-inflammatory properties, rooted in its *Shothahara* (anti-inflammatory) action in Ayurveda, are mediated through the suppression of pro-inflammatory cytokines such as Tumor Necrosis Factor-alpha (TNF- $\alpha$ ) and Interleukin-6 (IL-6). Modern research highlights the role of Amalaki’s polyphenols in inhibiting Nuclear Factor-kappa B (NF- $\kappa$ B) signaling, a key pathway in inflammation”. By reducing systemic inflammation, Amalaki protects against vascular damage and supports overall cardiac health, bridging traditional anti-inflammatory concepts with modern molecular insights (Kapoor *et al.*, 2020).

### Endothelial Protection and Anti-Thrombotic Effects

Endothelial dysfunction is an early indicator of cardiovascular illness because of the critical role it plays in preserving vascular homeostasis. According to Ayurveda, amalaki has a number of beneficial effects on the cardiovascular system, including enhancing circulation and strengthening the heart. A recent meta-analysis found that Amalaki increases endothelial function, vasodilation, and blood flow by increasing the bioavailability of Nitric Oxide (NO). In addition, it helps protect against myocardial infarction and stroke by preventing clot formation via its anti-thrombotic actions, which are achieved by reducing fibrinogen levels and inhibiting platelet aggregation. These two effects highlight the potential of Amalaki as a complete agent that protects the heart.

### Mechanistic Insights from Preclinical and Clinical Studies

“The cardioprotective effects of Amalaki (*Emblia officinalis*) have been extensively investigated in both preclinical (animal) and clinical (human) studies, providing valuable insights into its mechanisms of action and therapeutic potential”. These studies have explored its dose-dependent effects on cardiac biomarkers, its role in mitigating ischemia-reperfusion injury and myocardial infarction, and its overall impact on cardiovascular health. However, while the findings are promising, certain limitations in

**Table 1: Taxonomic Classification.**

“Order	Euphorbiales
Family	Euphorbiaceae
Genus	Emblia
Species	<i>Emblia officinalis</i>
Local name	Amalaki
Common names	Indian Gooseberry, Amalaki, Aonla, Emblic, Amloki, Nelli, Dhatri”

the existing research highlight the need for further investigation (Reddy *et al.*, 2010).

### Dose-Dependent Effects on Cardiac Biomarkers

Preclinical studies on animal models have demonstrated that Amalaki exhibits dose-dependent cardioprotective effects. For instance, research on rats has shown that Amalaki extract significantly reduces serum levels of cardiac “biomarkers such as Creatine Kinase-MB (CK-MB), Lactate Dehydrogenase (LDH), and troponin, which are elevated during myocardial injury. These effects are attributed to Amalaki’s antioxidant and anti-inflammatory properties, which stabilize cell membranes and prevent leakage of these enzymes into the bloodstream”. Human studies have corroborated these findings, with clinical trials reporting improvements in lipid profiles, blood pressure, and oxidative stress markers following Amalaki supplementation. For example, a Randomized Controlled Trial (RCT) involving hyperlipidemic patients found that daily consumption of Amalaki powder significantly reduced total cholesterol, LDL, and triglycerides while increasing HDL levels (Yokozawa *et al.*, 2007).

### Amalaki’s Role in Ischemia-Reperfusion Injury and Myocardial Infarction

Ischemia-reperfusion injury, a major complication following myocardial infarction, is characterized by oxidative stress, inflammation, and cell death. Preclinical studies have shown that Amalaki pretreatment reduces infarct size, improves cardiac function, and enhances survival rates in animal models of ischemia-reperfusion injury. These benefits are mediated through the upregulation of antioxidant enzymes, inhibition of

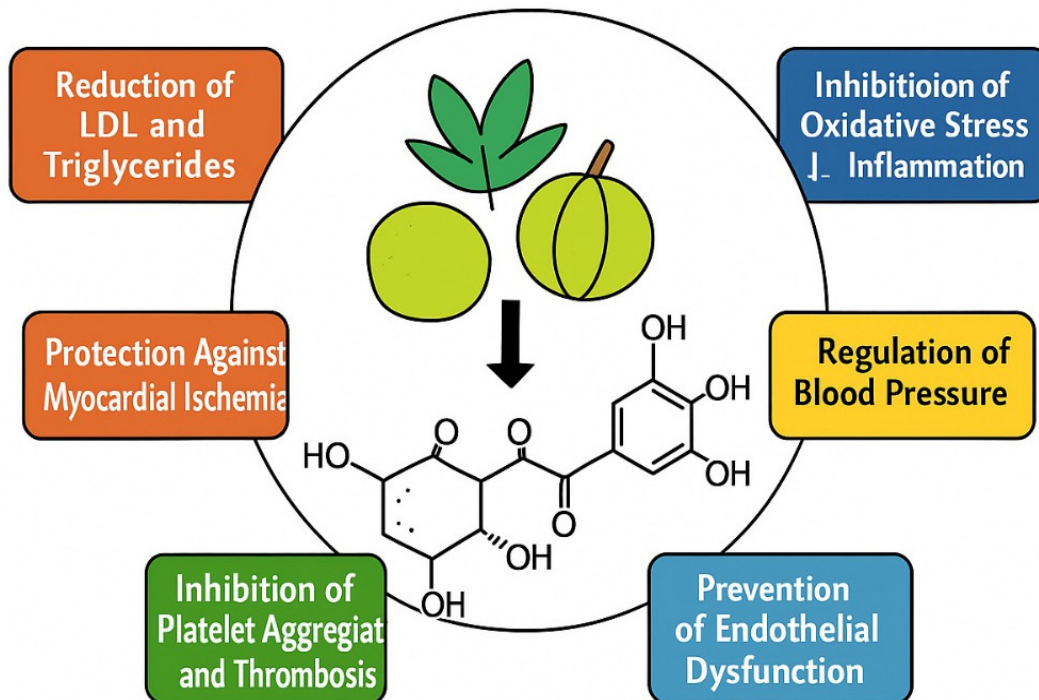
apoptotic pathways, and reduction of inflammatory cytokines. In human studies, Amalaki’s potential in post-myocardial infarction recovery is supported by its ability to improve endothelial function and reduce oxidative stress, although large-scale clinical trials are needed to confirm these findings (Yokozawa *et al.*, 2007).

### Comparative Analysis: Ayurvedic Claims vs. Modern Evidence

Amalaki’s cardioprotective properties, deeply rooted in Ayurveda as *Hridaya* (heart-friendly) and *Medohara* (fat-reducing), are increasingly validated by modern scientific research. Ayurvedic texts describe Amalaki as a *Rasayana* (rejuvenator) that combats oxidative stress (*Ama*), balances lipid metabolism, and supports heart health by cooling and calming the body (*Pitta Shamaka*). Modern studies corroborate these claims, demonstrating Amalaki’s

**Table 2: Phytochemical Composition of Amalaki.**

Phytochemical Group	Key Compounds	Biological Activity
Tannins	Embliganin A and B, Punigluconin.	Antioxidant, Anti-aging
Flavonoids	Quercetin, Kaempferol	Anti-inflammatory, Cardioprotective.
Phenolic Acids	Gallic Acid, Ellagic Acid	Antioxidant, Anti-cancer
Alkaloids	Phyllantine, Phyllantidine	Neuroprotective, Anti-diabetic
Vitamins and Minerals	Vitamin C, Chromium, Zinc	Immunomodulatory, Metabolic Support.



**Figure 1:** Cardioprotective and Metabolic Benefits of β-Glucogallin Derived from *Emblica officinalis*.

**Table 3: Cardioprotective Effects of Amalaki.**

Mechanism	Scientific Evidence
Antioxidant Activity	Enhances SOD, GPx, and reduces lipid peroxidation
Lipid-Lowering Effects	Reduces LDL, triglycerides; increases HDL
Anti-hypertensive Effects	Increases nitric oxide, inhibits ACE
Anti-inflammatory Effects	Suppresses TNF- $\alpha$ , IL-6, NF- $\kappa$ B signaling
Endothelial Protection	Enhances vascular function, reduces oxidative stress

ability to scavenge free radicals, reduce LDL and triglycerides, enhance HDL, lower blood pressure through nitric oxide and ACE inhibition, and suppress pro-inflammatory cytokines like TNF- $\alpha$  and IL-6. Additionally, its endothelial-protective and anti-thrombotic effects align with Ayurveda's emphasis on improving *Rakta Dhatu* (blood quality). However, gaps remain, such as the need for larger human trials, standardized formulations, and long-term safety studies to fully validate traditional claims. Despite these limitations, the convergence of Ayurvedic wisdom and modern evidence highlights Amalaki's potential as a natural cardioprotective agent, offering a holistic approach to cardiovascular health. Future research should focus on bridging these gaps and exploring integrative applications to harness Amalaki's full therapeutic potential.

## RESULTS

Clinical and preclinical investigations have shown that amalaki (*Emblica officinalis*) has strong cardioprotective characteristics. Its antioxidant effects decrease lipid peroxidation and oxidative stress by increasing enzymes such as Glutathione Peroxidase (GPx) and Superoxide Dismutase (SOD). In order to prevent atherosclerosis, amalaki lowers total cholesterol, LDL, and triglycerides while raising HDL levels. Its anti-hypertensive actions are due to its ability to inhibit the Angiotensin-Converting Enzyme (ACE) and increase NO generation. Amalaki also reduces inflammation in the blood vessels by inhibiting NF- $\kappa$ B activation and lowering levels of pro-inflammatory cytokines (TNF- $\alpha$ , IL-6). In addition to preventing thrombosis and improving endothelial function, it increases NO bioavailability. Amalaki pretreatment improves cardiac function in ischemia-reperfusion injury models and reduces infarct size. Supplementing with amalaki reduces cardiac damage indicators (CK-MB, LDH, troponin)", improves lipid profiles, and decreases blood pressure, according to human studies.

## DISCUSSION

The cardioprotective effects of Amalaki, deeply rooted in Ayurvedic traditions, are increasingly supported by modern scientific research. Its ability to mitigate oxidative stress, modulate lipid metabolism, reduce hypertension, and suppress inflammation aligns with its traditional role as a Rasayana (rejuvenator) and Hridya (heart-friendly) herb. Modern studies validate these effects, showing Amalaki's potential in preventing atherosclerosis, improving endothelial function, and reducing cardiac injury markers. However, while preclinical and some clinical studies are promising, more large-scale, Randomized Controlled Trials (RCTs) are needed to confirm its efficacy and safety in humans. The integration of Ayurvedic wisdom with modern science highlights Amalaki's potential as a holistic, natural approach to cardiovascular health, addressing both symptoms and underlying causes of cardiovascular diseases. Further research is essential to fully establish its therapeutic role in modern cardiology.

## CONCLUSION

Amalaki (*Emblica officinalis*) emerges as a promising natural cardioprotective agent, supported by both traditional Ayurvedic wisdom and modern pharmacological evidence. Its rich phytochemical profile—including vitamin C, polyphenols, flavonoids, and tannins—contributes to its potent antioxidant, anti-inflammatory, lipid-lowering, antihypertensive, and endothelial-protective effects. Preclinical and clinical studies consistently demonstrate its ability to reduce oxidative stress, improve lipid metabolism, regulate blood pressure, and prevent atherosclerosis, thereby addressing major risk factors of cardiovascular diseases. While the convergence of Ayurvedic insights and modern science reinforces Amalaki's therapeutic relevance, current evidence is still limited by small sample sizes and variations in formulations across studies. Large-scale, randomized controlled trials and standardized preparations are essential to validate its efficacy and ensure safety for widespread clinical use. In conclusion, Amalaki holds significant potential as a cost-effective, safe, and holistic approach for cardiovascular health management. Integrating this traditional remedy with modern therapeutic strategies could offer a sustainable pathway in combating the growing global burden of cardiovascular diseases.

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## ABBREVIATIONS

**CVDs:** Cardiovascular Diseases; **RCTs:** Randomized Controlled Trials; **LDL:** Low-Density Lipoprotein; **HDL:** High-Density Lipoprotein; **TNF- $\alpha$ :** Tumor Necrosis Factor-alpha; **IL-6:** Interleukin-6; **NF- $\kappa$ B:** Nuclear Factor-kappa B; **NO:** Nitric

Oxide; **ACE**: Angiotensin-Converting Enzyme; **ROS**: Reactive Oxygen Species; **SOD**: Superoxide Dismutase; **GPx**: Glutathione Peroxidase; **CK-MB**: Creatine Kinase-MB; **LDH**: Lactate Dehydrogenase.

## CONFLICT OF INTEREST

All authors declare that there is no conflict of interest.

## SUMMARY

This review highlights the cardioprotective potential of Amalaki (*Emblca officinalis*) by bridging insights from Ayurveda and modern medical science. Traditionally revered as a Rasayana (rejuvenator) and Hridya (heart tonic), Amalaki has long been used in Ayurvedic medicine for promoting vitality and heart health. Modern research validates these claims, attributing its efficacy to a rich phytochemical profile that includes vitamin C, flavonoids, polyphenols, and tannins. These compounds contribute to multiple therapeutic effects, including antioxidant, anti-inflammatory, lipid-lowering, antihypertensive, endothelial-protective, and anti-thrombotic actions. Evidence from preclinical and clinical studies shows Amalaki's ability to reduce oxidative stress, improve lipid profiles, regulate blood pressure, and protect cardiac tissues from ischemic and inflammatory injury. Comparative analysis demonstrates strong alignment between Ayurvedic concepts and scientific findings, reinforcing Amalaki's relevance in preventing and managing cardiovascular diseases. However, limitations such as small clinical trial sizes and lack of standardized formulations highlight the need for large-scale, randomized controlled trials to confirm efficacy and ensure safety. Overall, this review establishes Amalaki as a promising, safe, cost-effective, and holistic cardioprotective agent, offering integrative value in reducing the global burden of cardiovascular diseases.

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