Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/54yjpx53

A COMPREHENSIVE REVIEW ON ANTI-HYPERLIPIDEMIC DRUGS IN AYURVEDA

Dr. Akash Meghwal[1*], Dr. Prem kumar[2], Dr. Nikita panwar[3], Dr. Manoj Adlakha[4], Dr. Chandan Singh,[5]

[1*]MD Scholar, PG Dept Of Dravyaguna Vigyan PGIA DSRRAU Jodhpur
[2]Assistant Professor, PG Dept Of Shalya Tantra, PGIA DSRRAU Jodhpur
[3]Assistant Professor, PG Dept Of Dravyaguna Vigyan PGIA DSRRAU Jodhpur
[4]Associate Professor, PG Dept Of Dravyaguna Vigyan PGIA DSRRAU Jodhpur
[5]Professor And Head, PG Dept Of Dravyaguna Vigyan PGIA DSRRAU Jodhpur

***Corresponding Author:** Dr. Akash Meghwal
[*]MD scholar, PG dept of Dravyaguna vigyan PGIA DSRRAU Jodhpur

Abstract
Dyslipidemia continues to be a leading cause of cardiovascular morbidity, and Ayurvedic system therapy reports many plant therapies with major lipid-lowering properties. Systematic evaluation of important plants, such as *Commiphora mukul, Berberis aristata, Curcuma longa, Picrorhiza kurroa, Plumbago zeylanica, Cyperus rotundus*, and the polyherbaceous preparation *Triphala*, underscores their pharmacognostic qualities and bioactive constituents. These drugs work by complementary biochemical mechanisms like inhibition of HMG-CoA reductase, activation of the AMP-activated protein kinase, stimulation of bile acid secretion, modulation of the peroxisome proliferator-activated receptors, and enhancement of the antioxidant defense systems. Together, these mechanisms promote reduced cholesterol synthesis, enhanced fatty acid oxidation, improved lipid clearance, and protection against Low-Density Lipoprotein (LDL) oxidation. Preclinical trials and clinical trial evidence show consistent decreases in total cholesterol, LDL, and triglycerides and moderate increases in High-Density Lipoprotein (HDL). Polyphenols, terpenoids, and alkaloids have synergistic action, which is important in metabolic control and oxidative stress reduction. The majority of these compounds are largely free from side effects, and therefore, they can be used for long-term metabolic control. The integration of Ayurvedic concepts with molecular pharmacology makes them useful as adjuncts or alternatives to standard hypolipidemic drugs, especially in statin-intolerant populations. Ongoing standardization of the phytoconstituents, incorporation of network pharmacology, and strong multicentric clinical trials will be critical in realizing worldwide acceptance and formal integration of these plant therapeutics into evidence-based dyslipidemia management plans.

Keywords: Ayurvedic Medicine, Hyperlipidemia Management, Phytoconstituents, Molecular Pathways, Polyherbal Formulations, Lipid Profile Modulation

Introduction
Hyperlipidemia is one of the most significant metabolic abnormalities leading to cardiovascular morbidity and mortality globally. High serum lipid levels, such as cholesterol, triglycerides, Low-Density Lipoprotein Cholesterol (LDL-C), and Very-Low-Density Lipoprotein Cholesterol (VLDL-C), are the key risk factors for the pathogenesis of atherosclerosis, ischemic heart disease, stroke, and

metabolic syndrome (Sheik *et al.,* 2022). Dyslipidemia prevalence has exhibited a steady increase in tandem with lifestyle changes, urbanization, and dietary habits. Hyperlipidemia was found to impact a significant percentage of adults in developed and developing countries, according to epidemiological surveys, and made a notable contribution to the non-communicable disease burden (Chandran *et al.,* 2025). Not only do uncontrolled lipid derangements hasten cardiovascular morbidity, but they also increase the risk for other diseases like non-alcoholic fatty liver disease, chronic kidney disease, and endocrine disorders, mandating the implementation of effective control measures (Kaur *et al.,* 2021). Current medicine depends to a large extent on pharmacologic agents like statins, fibrates, bile acid sequestrants, cholesterol absorption inhibitors, and proprotein convertase subtilisin/kexin type 9 (PCSK9) inhibitors to control lipids. Statins are still the therapy of choice as they inhibit HMG-CoA reductase, leading to decreased hepatic cholesterol synthesis and better cardiovascular outcomes. Despite their great efficacy, prolonged use is linked to negative side effects like myopathy, hepatotoxicity, and diabetes mellitus (Ghosh *et al.,* 2021). Similar to fibrates, they significantly lower triglycerides at the expense of gallstones, gastrointestinal distress, and the possibility of drug interactions. Although more recent classes, such as PCSK9 inhibitors, significantly lower LDL-C, they are not commonly used due to their high cost. The drawbacks of conventional therapy emphasize the need for long-term, safe, and efficient alternative or adjunctive therapies (Rana *et al.,* 2022).

Ancient health systems, particularly Ayurveda, have emphasized integrative management of metabolic conditions for centuries. In Ayurvedic scriptures, hyperlipidemia can be identified with *Medoroga* and *Sthaulya*, wherein imbalance of *Kapha dosha*, impaired metabolism (*Aginmandya*), and stasis of metabolites (*Ama*) have been considered contributory factors. Literature like *Charaka Samhita* and *Sushruta Samhita* discusses different herbal formulations and monobotanical medicines with application in fat metabolism disorders, obesity, and cardiovascular derangements (Nalla *et al.,* 2023). Therapeutic logic in Ayurveda relies on *Rasapanchaka—Rasa* (taste), *Guna* (quality), *Virya* (potency), *Vipaka* (post-digestive effect), and *Prabhava* (specific action)—and *Dravyaguna Vigyana*, the detailed pharmacological understanding of medicinal substances. These ideas provide not just treatment hints but predictive insight into pharmacological activities, many of which are presently being validated by recent experimental research (Padhar *et al.,* 2021). Various plant materials described in Ayurveda exhibit lipid-lowering, antioxidant, hepatoprotective, and cardioprotective properties. Among them, *Curcuma longa* (Haridra), *Berberis aristata* (Daruharidra), *Cyperus rotundus* (Nagarmotha), *Saussurea lappa* (Kushta), *Picrorhiza kurroa* (Katuki), *Plumbago zeylanica* (Chitraka), and *Commiphora mukul* (Guggulu) have received significant scientific interest (Sahu *et al.,* 2023). These agents include bioactive constituents such as *curcuminoids*, *berberine, kutkoside, plumbagin*, and *guggulsterones* that reveal potential mechanisms such as inhibition of cholesterol biosynthesis, enhanced excretion of bile acid, activation of Peroxisome Proliferator-Activated Receptors (PPARs), reduction of oxidative stress, and enhancement of endothelial function. Besides pharmacological actions, these plants are firmly established in Ayurvedic clinical practice with recommendations for therapeutic use in *Medovriddhi, Prameha*, and related conditions (Upadhyay, 2021).

The intersection of Ayurvedic wisdom with contemporary pharmacological study is gradually gaining traction, especially within the field of cardiovascular and metabolic well-being. Natural agents are becoming more widely regarded as viable alternatives or complementary agents to man-made drugs, providing enhanced safety profiles and multifaceted mechanisms of action. *Triphala, Medohara Yoga*, and *Guggulu Kalpa* are some common examples of synergistic therapy using the traditional style, where formulations of herbs can interact with various metabolic pathways and produce a single lipid regulation. Recent experimental and clinical studies confirms the effectiveness of such preparations, but there are significant problems of dosage optimisation, quality control, and standardisation to allow wide clinical usage (Choudhari *et al.,* 2024). The scientific evaluation of Ayurvedic anti-hyperlipidemic drugs will be a possible to combine the traditional and modern methods of treatment. A clear understanding of the pharmacognostic characteristics, phytochemical composition, pharmacological actions, and Ayurvedic characteristics like *Rasapanchaka* can be highly beneficial in developing drugs rationally (Tiwari *et al.,* 2025). The importance of safeguarding biodiversity, ethnopharmacological heritage and the incorporation of traditional medicine into modern healthcare systems is also emphasised by this type of evaluation. With a growing global focus on natural therapies and integrative medicine, the ayurvedic botanicals could provide long-term effects in the treatment of hyperlipidemia (Rahmat *et al.,* 2024).

The present study aims to provide a comprehensive synthesis of anti-hyperlipidemic drugs described in Ayurveda, focusing on selected botanicals including *Cyperus rotundus*, *Saussurea lappa*, *Curcuma longa*, *Berberis aristata*, *Acorus calamus*, *Aconitum heterophyllum*, *Picrorhiza kurroa*, *Plumbago zeylanica*, *Holoptelia integrifolia*, *Iris germanica*, and *Feronia elephantum* (Sethi & Gupta, 2023). Each plant will be discussed in terms of taxonomy, habitat, morphology, phytochemistry, pharmacological activities, therapeutic uses, and Ayurvedic attributes, thereby presenting a holistic perspective. By collating classical wisdom with experimental and clinical data, this study seeks to highlight the relevance of Ayurvedic plants in combating hyperlipidemia and associated metabolic disorders, while outlining their potential role in future drug discovery and integrative healthcare (Ahmad *et al.,* 2024).

Hyperlipidemia: Biomedical and Ayurvedic Perspectives

Biomedical Aspects (Classification: Primary vs. Secondary Hyperlipidemia)

Hyperlipidemia is a wide variety of diseases, which are defined by excessive amounts of lipids in serum, cholesterol, triglycerides, or both. Contemporary classification identifies two basic forms of this, namely primary and secondary ones, which inform clinical assessment and treatment decision-making. Primary hyperlipidemia is caused by inherited defects in the metabolism of lipids (Rachitha *et al.,* 2023). Examples are familial hypercholesterolemia with mutations in the LDL receptor gene, such that it can no longer clear LDL out of circulation, and familial combined hyperlipidemia, which is an overproduction of lipoproteins containing apolipoprotein B. The APOE gene polymorphisms are associated with dysbetalipoproteinemia, which results in impaired clearance of remnants and, consequently, premature atherosclerosis. These inherited diseases can appear at an early age, are not related to diet or lifestyle changes, and may need a lifelong course of medications (Pathak *et al.,* 2021).

Secondary hyperlipidemia is much more common, and it occurs as a side effect of metabolic or systemic imbalances. Uncontrolled diabetes mellitus changes the insulin signaling and augments the production of VLDL. Hypothyroidism decreases the LDL receptor expression, increasing plasma LDL. The presence of conditions like nephrotic syndrome, chronic kidney disease, liver dysfunction, obesity, and metabolic syndrome alters lipid clearance, enhancing free fatty acid flux and hepatic triglyceride production (Gothwal *et al.,* 2023). Lipid imbalance is further worsened by chronic alcohol consumption, a high-saturated-fat diet, long-term corticosteroid, antiretroviral substances, or some diuretics. It is necessary to understand the presence of primary or secondary dyslipidemia to determine reversible factors and to be able to treat it (Pundir *et al.,* 2024).

Pathophysiology: Cholesterol Metabolism, LDL/HDL Dynamics, Oxidative Stress

The relationship between the intestinal absorption, hepatic synthesis, and peripheral clearance is important in lipid homeostasis. Cholesterol is formed by the liver by a pathway called HMG-CoA reductase and is then packaged in VLDL and secreted into the bloodstream. VLDL is then broken down by lipoprotein lipase to form intermediate-density lipoproteins, which eventually become LDL particles (Mali & Shekokar, 2023). LDL transports cholesterol to peripheral tissues but also gets to the inner walls of the arteries, where, when exposed to oxidative or inflammatory environments, it is modified and leads to the formation of atheromas. Scavenger reuptake of oxidized LDL by the macrophages results in the development of the foam cell, which forms the lipid core of atherosclerotic plaques (Yadav & Singh, 2023). HDL has a counter-regulatory role, and it engages in reverse cholesterol transportation. It gathers surplus cholesterol by the macrophage and peripheral tissues and transfers it to the liver to be excreted in bile acids. Low HDL level or poor LDL/HDL ratio is closely associated with the risk of cardiovascular diseases (Singh *et al*., 2025). Oxidative stress is a stimulus in atherosclerosis. Endothelial activation, the expression of adhesion molecules, and inflammation of the vascular wall are elicited by the reaction of LDLs with Reactive Oxygen Species (ROS) produced during mitochondrial dysfunction or chronic inflammation. Disruption of inbuilt antioxidant enzymes like superoxide dismutase, catalase, and glutathione peroxidase worsens this cycle, which, on the one hand, contributes to the instability of the plaque and thrombosis. This pathophysiology forms the basis behind therapies that strive to reduce LDL, increase HDL, and augment antioxidant abilities (Manpreet *et al.,* 2017).

Concept of Medoroga and Kapha-Meda Vriddhi

Ayurveda is the concept of hyperlipidemia, as the *Medoroga*, the disorder of hyperlipid pathological increase of *Meda dhatu* (adipose tissue), and unbalanced lipid metabolism. According to classical texts, this condition is caused by the aggravation of the dosha *Kapha* that brings the natures of heaviness, unctuousness, and sluggishness into the metabolism of the tissues. *Kapha-Meda vriddhi* (excessive acculturation of *Meda dhatu*) can be compared to the biomedical concept of dyslipidemia and obesity. It is said to lead to metabolic efficiency, stagnation, and structural and functional damage to srotas (microchannels) (HERB, 2017). *Meda dhatu agni*, or metabolic fire of adipose tissue, is the most significant factor in lipid homeostasis. The imbalance of this *agni* slows down lipid metabolism, and the surplus fat is deposited in tissues and vascular channels. Physical signs encompass body flabbiness, physical sloveness, dyspnea on exertion and susceptibility to complications such as cardiovascular diseases and *Prameha* (diabetes). This concept is employed to highlight a systemic perspective where hyperlipidemia is an imbalance in the whole body and not a biochemical defect. (Pasam *et al.,* 2023).

Role of Agnimandya and Ama

Medoroga is believed to be caused by *agnymandya*, the digestive and metabolic fire, not functioning properly. Agni impairment causes an insufficient digestion and assimilation process, which causes the accumulation of *Ama*, a byproduct of toxins, consisting of unmetabolized nutrients. Ama circulates inside the body and blocks *srotas* (microcirculatory channels) and causes pathological accumulation of *Kapha* and *Meda*. This model is echoed in the current knowledge of metabolic endotoxemia and oxidative stress. *Ama* can be considered similar to oxidized LDL or free radicals, which have been known to cause inflammatory cascades and endothelial dysfunction. Therefore, *Agni*-rejuvenation with diet, herbs, and the modification of lifestyle is core to Ayurvedic management since it prevents the synthesis of *Ama* and encourages adequate lipid utilization (Mali & Shekokar, 2023).

Ayurvedic Therapeutic Approaches: Shamana and Shodhana

In *shamanic* therapy, doshic balance is restored using herbal preparations and diet to enhance *Meda dhatu agni*. The rasa of herbs with *Tikta* (bitter) and *Katu* (pungent), *Laghu* (light) *guna*, and Ushna (hot) *virya* are desired to decrease *Kapha* and dissolve Meda. *Triphala, Guggulu Kalpa*, and *Medohara* Yoga are classical formulations that are commonly used. These combinations evidently possess lipid-lowering, hepatoprotective, and antioxidant properties, which agree with contemporary pharmacological evidence on the guggulsterones, gallic acid, and other phytoconstituents (Banerjee *et al*., 2024). Practices of systemic detoxification by way of Panchakarma are intended by *Shodhana* therapy. *Vamana* (therapeutic emesis) and *Virechana* (therapeutic purgation) are especially useful in disorders that are predominantly *Kaphic* and *Pittic*. These interventions help to increase the efficiency of metabolic processes in the body and prevent the relapse of lipid disorders by getting rid of accumulated toxins and restoring the balance of doshas. *Basti* (medicated enema) and *Raktamokshana* (controlled bloodletting) can be selectively applied to eliminate remaining pathology as a means to enhance circulatory wellbeing (Kumar & Pundir, 2022). The lifestyle interventions are a critical part of the therapy. Scheduling the best time to eat, avoiding excessive consumption of foods containing fat and excessive sugar, physical exercises, and yoga and pranayam as a form of stress-free life measures are recommended. The combination of these interventions helps deal with immediate biochemical derangements as well as their constitutional cause, which has a comprehensive and preventative approach (Huddar *et al.,* 2023).

Integrative Perspective

Similarities in the concepts applied in biomedical and Ayurvedic accounts of lipid disorders reveal a high level of overlap. *Kapha-Meda vriddhi* is associated with adiposity and dyslipidemia, *Agnimandya* is associated with decreased metabolic rate, and Ama is similar to oxidative and inflammatory metabolites, which favor atherogenesis. The Ayurvedic interventions are not only at the lipid levels, but there is a target to the digestive fire, systemic detoxification, and correction of lifestyle, which provides a multi-layered approach (Fuloria *et al.,* 2022). Table 1 represents Ayurvedic understanding of hyperlipidemia (*Medoroga*) by matching classical concepts like *Kapha-Meda vriddhi*, *Agnimandya, Ama*, and *Srotorodha* with their biomedical counterparts, and that gives the integrative view of disease pathology.

Table 1: Ayurvedic Perspective of Hyperlipidemia (*Medoroga*)

Concept	Description	Biomedical Correlation	
Kapha-Meda vriddhi	Abnormal increase of Kapha and adipose tissue	Obesity, lipid accumulation	(Mali & Shekokar, 2023)
Agnimandya	Impaired digestive/metabolic fire	Reduced lipid metabolism, insulin resistance	(Singh *et al.,* 2025)
Ama	Undigested, toxic metabolic products	Oxidized LDL, free radicals	(Banerjee *et al*., 2024)
Srotorodha	Obstruction of body channels	Atherosclerotic plaque formation	(Ahmad *et al.,* 2024)

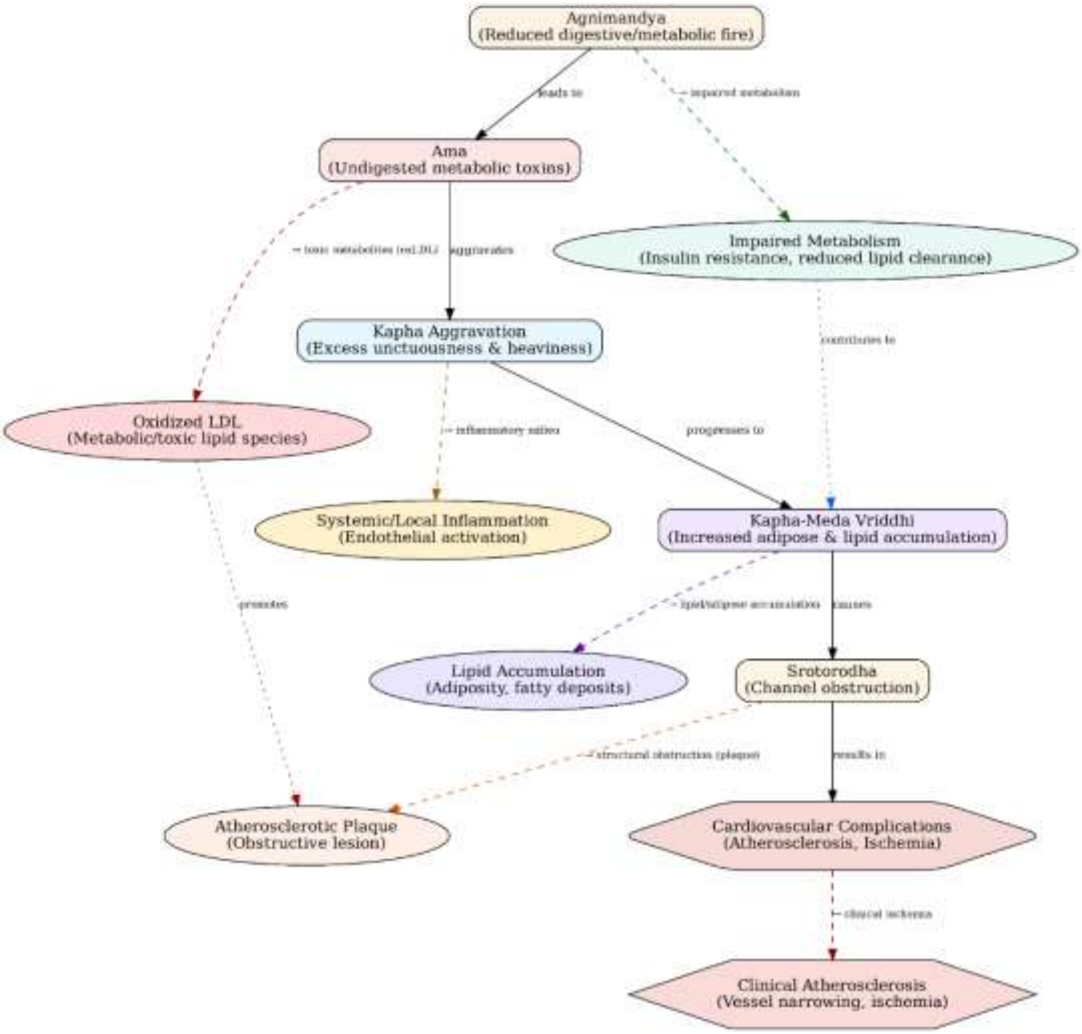

Figure 1: Ayurvedic Conceptual Framework of Hyperlipidemia (*Medoroga*)

Figure 1 shows Ayurvedic ideas of *Agnimandya, Ama, Kapha-Meda vriddhi,* and *Srotorodha* alongside the biomedical counterparts such as impaired metabolism, oxidized LDL, inflammation, and formation of a plaque, demonstrating a convergence between the traditional and the modern perspectives of hyperlipidemia.

Anti-Hyperlipidemic Drugs in Ayurveda

Medicinal utility of medicinal plants in the management of hyperlipidemia has been widely underscored in Ayurvedic written sources, whereby *Medoroga* is regarded as a lipid metabolic disorder, which is mostly controlled by impairments in *Kapha dosha* and *Meda dhatu*. The contemporary pharmacological study has reported several phytoconstituents with lipid-lowering effects, which include alkaloids, flavonoids, terpenoids, and phenolics that act in various ways, including blockage of cholesterol uptake, promotion of lipid metabolism, and antioxidant activity (Saklani *et al.,* 2024). Classical Ayurvedic literature also offers another interpretative scheme in the form of *Rasa Panchaka* (taste, potency, post-digestive effect, specific action, and bioenergetic effect), which explains drug action from a holistic viewpoint. Table 2 shows the botanical, pharmacognostic, and therapeutic features of the Ayurvedic plants that were identified with documented anti-hyperlipidemic activity, such as their morphology, phytoconstituents, pharmacological effects, and Ayurvedic explanations like *Rasa Panchaka*. This comparison of similarities highlights how they are considered from traditional and modern angles in the treatment of hyperlipidemia (Choudhary *et al.,* 2021).

Table 2: Pharmacognostic and Therapeutic Profile of Selected Anti-Hyperlipidemic Plants in Ayurveda

Botanical Name (Family)	Habitat & Morphology	Key Phytoconstituents	Ayurvedic Perspective (Rasapanchaka & Dravyaguna)	Traditional & Modern Uses	Reported Pharmacological Activities	Evidence (Preclinical/Clinical)	Safety Profile	References
Cyperus rotundus (Cyperaceae)	Perennial sedge grows in tropical & subtropical zones, with tuberous rhizomes.	Flavonoids, sesquiterpenes, cyperene, patchoulenone	Rasa: Tikta, Katu; Guna: Laghu, Ruksha; Virya: Sheeta; Vipaka: Katu; Doshaghna: Kapha-Pitta Shamak	Used in digestive disorders, obesity, and lipid imbalance	Antihyperlipidemic, antioxidant, anti-inflammatory	Animal models show significant lipid-lowering activity	Safe in moderate doses; high doses may cause GI irritation	(Kandikattu *et al.,* 2022)
Saussurea lappa (Asteraceae)	Herbaceous, found in the Himalayan regions	Sesquiterpene lactones (costunolide, dehydrocostus lactone), alkaloids	Rasa: Tikta, Katu; Guna: Laghu, Ruksha; Virya: Ushna; Vipaka: Katu; Kapha-Vata Shamak	Treats dyslipidemia, asthma, and joint disorders	Lipid-lowering, hepatoprotective, anti-inflammatory	In vivo studies report improved lipid profiles	Caution in pregnancy; hepatotoxic in very high doses	(Kumar *et al.,* 2025)
Curcuma longa (Zingiberaceae)	Rhizomatous herb, widely cultivated in India	Curcumin, turmerone, essential oils	Rasa: Tikta, Katu; Guna: Laghu, Ruksha; Virya: Ushna; Vipaka: Katu; Kapha-Vata Shamak	Used in metabolic syndrome, obesity, and diabetes	Hypolipidemic, antioxidant, anti-atherosclerotic	Human trials show LDL reduction, HDL elevation	Generally safe; high doses may cause gastric upset	(Panda *et al.,* 2021)
Berberis aristata (Berberidaceae)	A shrub native to the Himalayan belt	Berberine, oxyberberine, berbamine	Rasa: Tikta, Kashaya; Guna: Laghu, Ruksha; Virya: Ushna; Vipaka: Katu; Kapha-Pitta Shamak	Liver disorders, jaundice, dyslipidemia	Hypolipidemic, hypoglycemic, hepatoprotective	Clinical evidence supports lipid-lowering via berberine	Well tolerated; mild GI side effects	(Ahamad *et al.,* 2021)
Acorus calamus (Araceae)	Semi-aquatic, aromatic rhizomes	β-asarone, acorin, flavonoids	Rasa: Tikta, Katu; Guna: Laghu, Tikshna; Virya: Ushna; Vipaka: Katu; Kapha-Vata Shamak	Improves digestion, clears channels, reduces fat	Lipid-lowering, antioxidant, neuroprotective	Animal studies show TG & LDL reduction	Chronic high-dose use linked to carcinogenicity (β-asarone)	(Chatterjee *et al.,* 2024)
Aconitum heterophyllum (Ranunculaceae)	Herbaceous perennial in the alpine Himalayas	Atisine, heteratisine (alkaloids)	Rasa: Tikta; Guna: Laghu, Ruksha; Virya: Sheeta; Vipaka: Katu; Tridoshaghna	Used for fevers, GI disorders, and metabolic imbalance	Antihyperlipidemic, hepatoprotective (limited data)	Preclinical studies indicate lipid modulation	Potential toxicity in raw form; safe after purification	(Talreja & Tiwari, 2023)

Picrorhiza kurroa (Plantaginaceae)	Small perennial herb, Himalayan regions	Kutkoside, picroside I & II, apocynin	Rasa: Tikta; Guna: Laghu, Ruksha; Virya: Sheeta; Vipaka: Katu; Kapha-Pitta Shamak	Liver stimulant, obesity, dyslipidemia	Lipid-lowering, hepatoprotective, antioxidant	Both preclinical and clinical data support efficacy	Safe under therapeutic range	(Raina *et al.,* 2021)
Plumbago zeylanica (Plumbaginaceae)	Evergreen shrub, roots reddish-brown	Plumbagin, sitosterol, tannins	Rasa: Katu, Tikta; Guna: Laghu, Tikshna; Virya: Ushna; Vipaka: Katu; Kapha-Vata Shamak	Used in obesity, digestive impairment	Lipid-lowering, anti-inflammatory	Animal models show lipid reduction	Irritant in high doses; contraindicated in pregnancy	(Tanwar *et al*., 2025)
Holoptelea integrifolia (Ulmaceae)	Large deciduous tree in India	Holoptelin A & B, β-sitosterol, tannins	Rasa: Tikta, Kashaya; Guna: Laghu, Ruksha; Virya: Ushna; Vipaka: Katu	Dyslipidemia, obesity, and arthritis	Lipid-lowering, antioxidant	Preclinical reports support efficacy	Safe in moderate use	(Tyagi *et al.*, 2022)
Iris germanica (Iridaceae)	Rhizomatous perennial, ornamental	Isoflavones, iridin, triterpenes	Rasa: Tikta; Guna: Laghu, Ruksha; Virya: Sheeta; Vipaka: Katu	Used in obesity, lipid imbalance	Antihyperlipidemic, hepatoprotective	Limited experimental data available	Safe at therapeutic doses	(Khatib *et al.,* 2022)
Feronia elephantum (Rutaceae)	Deciduous fruit tree, India & SE Asia	Marmelosin, coumarins, flavonoids	Rasa: Madhura, Kashaya; Guna: Guru, Ruksha; Virya: Sheeta; Vipaka: Madhura	Used in dyslipidemia, GI disorders	Hypolipidemic, antioxidant	Animal studies confirm lipid-lowering	Non-toxic in standard doses	(Vikhe *et al.,* 2023)
Commiphora mukul (Burseraceae)	Small tree, resin exudate "Guggulu"	Guggulsterones, essential oils	Rasa: Tikta, Katu; Guna: Laghu, Ruksha; Virya: Ushna; Vipaka: Katu; Kapha-Vata Shamak	Benchmark drug for Medoroga (obesity, dyslipidemia)	Strong hypolipidemic, anti-atherosclerotic	Human trials demonstrate significant lipid reduction	Generally safe; may cause mild skin rash	(Huddar *et al.,* 2023)

Comparative Analysis and Pharmacological Insights

Comparative Summary of Ayurvedic Anti-Hyperlipidemic Drugs

Despite having different pharmacognostic and phytochemical characteristics, the Ayurvedic plants under consideration all can lower cholesterol. Terpenoids (*guggulsterones, kutkosides*), alkaloids (*berberine*), flavonoids (*quercetin, rutin*), and phenolic compounds (*curcumin, plumbagin*) are crucial to the process of lipid modulation, according to the comparison of the evidence. Based on the Ayurvedic perspective, such agents are usually *Tikta* (bitter) and *Katu* (pungent), *Laghu* and *Ruksha guna*, *Ushna* or *Sheeta virya*, and most of them are *Kapha-Meda*. These qualities correspond to the current evidence that they work to lower the levels of triglycerides, increase the bile acids, and optimize the oxidative balance (Ghosh *et al.,* 2025). Table 3 shows the relative pharmacognostic, phytochemical, Ayurvedic, and therapeutic properties of the chosen anti-hyperlipidemic plants and combines the current pharmacological processes with the Rasa Panchaka conceptualization to emphasize the potential of these plants in treating lipid disorders and related complications.

Table 3: Comparative Pharmacological and Ayurvedic Attributes of Anti-Hyperlipidemic

Plant (Latin name)	**Key Bioactive Constituents**	**Pharmacological Mechanism**	**Ayurvedic Attributes (*Rasa Panchaka*)**	**Key Outcomes**	
Commiphora mukul	Guggulsterones	HMG-CoA reductase inhibition, bile acid metabolism modulation	Tikta, Katu; Laghu, Ruksha; Ushna; Katu vipaka	Decreases LDL, TG; increases HDL	(Dewangan *et al*., 2025)
Berberis aristata	Berberine	AMPK activation, LDL receptor upregulation	Tikta, Kashaya; Laghu, Ruksha; Ushna	Reduces cholesterol & glucose	(Wani *et al.,* 2022)
Curcuma longa	Curcumin	Antioxidant defense, NF-κB inhibition, lipid peroxidation reduction	Tikta, Katu; Laghu, Ruksha; Ushna	Prevents atherosclerosis, lowers LDL	(Das *et al.*, 2025)
Picrorhiza kurroa	Kutkosides	Hepatoprotective, bile acid stimulation	Tikta; Laghu, Ruksha; Sheeta	Improves lipid clearance, liver function	(HERB, 2017)

Plumbago zeylanica	Plumbagin	Lipid metabolism modulation, anti-inflammatory activity	Katu, Tikta; Laghu, Tikshna; Ushna	Lowers total cholesterol & TG	(Rachitha *et al*., 2023)
Cyperus rotundus	Sesquiterpenes, flavonoids	Antioxidant, lipid-lowering	Tikta, Katu; Laghu, Ruksha; Sheeta	Mild hypolipidemic activity	(Chandran *et al.,* 2025)
Triphala (polyherbal)	Gallic acid, ellagic acid, chebulinic acid	Antioxidant, PPAR-γ modulation	Tridoshahara	Improves lipid profile & gut health	(Nalla *et al.,* 2023)

Molecular Pathways Targeted by Ayurvedic Plants

The Ayurvedic anti-hyperlipidemic plants have a therapeutic effect mediated by the regulation of different molecular pathways related to lipid metabolism and oxidative balance. *Guggulsterones*, *berberine*, and other phytoconstituents are all HMG-CoA reductase inhibitors and work in a similar way as statins, suppressing the endogenous production of cholesterol. Polyphenolic compounds like *Triphala, Curcuma longa*, and others, cause effects upon the Peroxisome Proliferator-Activated Receptors (PPAR-α/ɣ) and can stimulate the rise in fatty acid oxidation and improved adipocyte differentiation control (Dewangan *et al.,* 2025). The activation of AMP-activated Protein Kinase (AMPK) by berberine is also useful in the regulation of lipids, as it improves fatty acid oxidation and glucose uptake. Moreover, *guggulsterones* and *picrosides* cause changes in the metabolism of bile acids to raise cholesterol and bile acid release. Besides these processes, curcumin, plumbagin and other flavonoids elevate the number of enzymes such as glutathione peroxidase, catalase and superoxide dismutase, which subsequently cause some antioxidant defence measures against oxidative stress and Low-Density Lipoprotein (LDL) oxidation. Collectively, these processes depict the role of Ayurvedic vegetation in the prevention and treatment of hyperlipidemia based on the biochemical integrative processes (Prakash *et al*., 2023).

Polyherbal Formulations and Synergistic Actions

Polyherbals that are used in Ayurvedic therapies can also lead to synergistic lipid-lowering properties. *Triphala* as a formulation of *Terminalia chebula, Terminalia bellirica*, and *Emblica officinalis,* possesses antioxidant, hypolipidemic, and hepatoprotective properties. *Medohara* Yoga contains various herbs that deal with digestion, metabolism, and fat loss. *Guggulu Kalpa* is a popular herbal compound that focuses on *Commiphora mukul* and is prescribed in *Medoroga* and obesity. These formulations are consistent with concepts of systems biology in that they regulate numerous molecular targets at once to improve therapeutic efficacy whilst reducing adverse effects (Wani *et al.,* 2022).

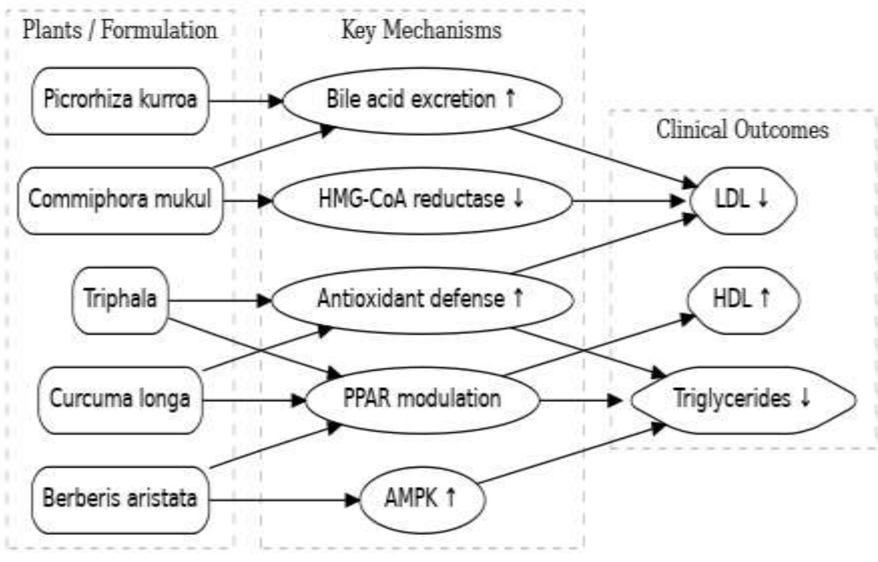

Figure 2: Integrated Pathways of Ayurvedic Anti-Hyperlipidemic Agents

Figure 2 shows a simplified pathway between important Ayurvedic plants, including Commiphora mukul, Berberis aristata, Curcuma longa, Picrorhiza kurroa, and Triphala, to significant mechanisms, including HMG-CoA reductase inhibitors, AMPK activators, bile acids excretion, antioxidant defence, and PPAR modulators.

Clinical Evidence and Therapeutic Relevance

Overview of Human Trials and Case Studies

Human clinical research on Ayurvedic botanicals gives ever-growing solid evidence of the hypolipidemic effects of Ayurvedic botanicals. Regulated studies on *Commiphora mukul* (guggul) found a reduction of serum total cholesterol, LDL cholesterol of between 15-25 per cent, with a moderate yet significant increase in the High-Density Lipoprotein (HDL). The results are commonly found after a period of 8-12 weeks of treatment, and its biochemical effects are sustained over short- and medium-duration treatment regimens. There are other advantages, such as lowering of the triglyceride levels and betterment of the lipid ratios, implying a holistic regulation of lipid metabolism (Kumar *et al.,* 2021). *Berberis aristata* contains preparations of berberine with considerable LDL receptor-activation and AMP-Activated Protein Kinase (AMPK) stimulation, translating into decreases in LDL, Very Low-Density Lipoprotein (VLDL), and triglycerides. The trials of comparison of berberine with the standard oral hypolipidemic drugs have similar or synergistic effects during combination therapy. *Triphala* is a classical polyherbal formulation that is clinically observed to precipitate improved lipid clearance, hepatic enzyme restoration to near-normal levels, and a decrease in systemic inflammatory indicators (e.g., C-reactive protein). Prolonged use in the community has been linked with an overall positive effect on the metabolic health outcomes, such as glycemic control, which applies to patients with metabolic syndrome (Akhilraj & Rukmini, 2021). Several studies have assessed *Curcuma longa* (curcumin) supplementation with a down-regulation of nuclear factor kappa B (NF-kB) signalling, leading to decreased oxidative stress and reduced LDL oxidation. This protection of antioxidant mediation is linked with a reduction in atherogenic risk and enhanced vascular performance. All these trials and a series of observations suggest that Ayurvedic interventions represent a scientifically supported approach to the minimisation of the severity of dyslipidemia, and could become effective supplements to the traditional pharmacotherapy (Tyagi *et al.,* 2022).

Safety and Tolerability

The application of these botanicals as therapeutic agents is defined by a relatively positive safety profile. Adverse effects are rare, and those that are reported are mild in nature in most cases. Light gastrointestinal illness, soft stools, or momentary abdominal pain are the most common incidents and normally self-resolve. Rare cases of dermatological response in the form of rash or pruritus have been reported with the use of guggulsterone; the reaction disappears after the drug is discontinued, implying idiosyncratic hypersensitivity, and not systemic toxicity (Das *et al.,* 2025). Toxicological evaluations of *Triphala* have shown that the compound does not have organ toxicity, even in doses exceeding those used in treating the organism. *Curcuma longa* has been linked to very good tolerability and other hepatoprotective properties with long-term usage. Markers of liver and kidney functioning will be the same or show an improvement during the treatment, which means that there is no hepatotoxic or nephrotoxic effect on the body. Standardisation of dose: due to fluctuation in sourcing of the raw material, phytoconstituent concentration, and formulation methods, potency may be affected, requiring the use of standardised extracts in clinical practice. The reproducibility and reduction of variability on therapeutic response are reinforced by quality control that is achieved by chromatographic profiling and marker-based quantification (Jatav *et al.,* 2023).

Translation Potential into Modern Lipid-Lowering Therapy

Ayurvedic pharmacodynamic analysis of Ayurvedic plants has shown significant similarity to the known mechanisms of action of lipid-lowering pharmacology. The direct action of *guggulsterones* is the inhibition of HMG-CoA reductase, which resembles the main target of statins, but less often reports of either myopathy or hepatotoxicity are associated. *Berberine* increases the expression of LDL receptors and activates the AMPK, which is a major energy homeostasis controller, leading to better lipid and glucose metabolism. Polyphenolic constituents in *Triphala* and *Curcuma longa* have actions in line with fibrate-class compounds, as they are Peroxisome Proliferator-Activated Receptor (PPAR) agonists that induce the processes of fatty acid oxidation and adipocyte differentiation (Nalla *et al.,* 2023). These intersections make such plant materials a possible substitute or complementary therapy for hyperlipidemia. They have a higher multitargeted action compared to the single-pathway agents and may have a synergistic effect with the conventional drugs. Their antioxidant and anti-inflammatory properties are also useful far beyond lipid management, up to stabilisation of atherosclerotic plaque and improvement of endothelial activity. These agents are potential therapeutic targets in statin-intolerant patients or patients who would like to use the plant-based interventions, since these would fill the gap between the traditional knowledge and the evidence-based clinical practice (Sahu *et al*., 2023). The translational implications are also that it is possible to come up with standard phytopharmaceuticals that have predictable pharmacokinetics and known dose-response relationships. Further enhancements could be made through the improvement of the clinical efficacy through advances in the science of formulations, such as nanoparticle delivery systems and strategies that could be used to enhance bioavailability. Such agents should be incorporated into the preventive cardiology guidelines as they would help to promote a holistic focus of cardiovascular risk prevention, in line with the worldwide health policies of lifestyle change and supplementary medicine (Tiwari *et al.,* 2025).

Challenges and Future Perspectives

Standardisation and Quality Control of Ayurvedic Plants

The inconsistency in phytochemicals is also one of the primary obstacles to the uniform therapeutic efficacy of Ayurvedic medicine. The bioactive constituents may differ greatly around the plant species, place, soils, season of harvest and after harvesting. Poor nomenclature of the plants or their replacement with closely related species may affect the efficacy and safety. It must have standardisation procedures, which will involve macroscopic, microscopic and chromatographic authentication, by which it will guarantee the reproducibility of the batch of tests. The accurate determination of the marker compounds can be achieved by the development of the validated pharmacopoeia monographs, the advanced techniques, including HPTLC and HPLC fingerprinting. There are also low amounts of pollution through pesticides, heavy metals, or microbial toxins, which are brought about by GACP and Good Manufacturing Practices (GMP). Only through strict quality assurance can clinical trials generate findings that are generalizable across populations and transplantable to other settings (Sheik *et al.,* 2022).

Bridging Classical Knowledge with Modern Drug Discovery

The Ayurvedic pharmacology classifies drug action as *Rasa* (taste), *Guna* (qualities), *Virya* (potency), *Vipaka* (post-digestive effect), and *Prabhava* (specific action). While these parameters form the theoretical framework of the therapy process, they may be maximised by mapping them into the contemporary molecular frameworks. It is possible to have a mechanistic explanation of their lipid-lowering effect through the pairing of bitter or pungent Rasa qualities with target receptors in lipid metabolism. Integration systems on classical descriptors and modern pharmacokinetics and pharmacodynamics can better predict bioavailability and therapeutic index. In addition, phytoconstituent lead molecules can also be discovered via fractionation and bioassay-guided isolation of phytoconstituents and can be optimised via structure-activity relationship studies. The disconnect between the two bodies of knowledge allows us to hold on to the use of traditional wisdom and attain scientific competency as required in the formulation of drugs globally (Kaur *et al.,* 2021).

Integration of Omics and Network Pharmacology Approaches

Existing omics technologies have presented a formidable platform to unravel the multi-target and multi-pathway nature of Ayurvedic intervention. Transcriptomic and proteomic profiling would have the capacity to establish how polyherbal preparations can alter the gene expression pattern in lipid synthesis, inflammation, and oxidative stress in a multifaceted manner. With the help of metabolomics, it will be possible to track the endogenous metabolites that will give the overall image of the system changes according to the treatment. These data sets are combined into a compound-target-pathways network to predict the synergistic or antagonistic activity of phytochemicals, commonly referred to as network pharmacology models. These methods can also forecast possible off-target effects and drug-herb interactions and can be used to make the integration with traditional therapy safer. Network analysis guided by artificial intelligence can further optimise the detection of important nodes to be therapeutically manipulated, enabling logical formulation of better formulations (Rana *et al.,* 2022).

Regulatory Frameworks for Global Acceptance

Botanicals and polyherbal mixtures are often complex in such a way that global regulatory agencies are confronted with problems assessing them. Contrary to single-molecule drugs, conventional formulations are subject to multidimensional analysis, such as chemical fingerprinting and toxicity profiling, and evidence of efficacy in properly designed clinical trials. It would be easier to achieve the widest international recognition through harmonisation of standards between pharmacopoeias, e.g., the Ayurvedic Pharmacopoeia of India, the WHO monographs, and the European Herbal Pharmacopoeia. The development of clinical trials must comply with Good Clinical Practice (GCP) standards, which require randomised controlled clinical trials and sufficient sample size, placebo or active controls, and standardised endpoints such as LDL-C levels decrease or normalisation of triglycerides. To identify the rare adverse events and to ensure pharmacovigilance, it is also necessary to conduct post-marketing surveillance. The clear regulatory process will help Ayurvedic anti-hyperlipidemic agents to be placed not as supplements alone, but as evidence-based therapeutic agents in cardiovascular care (Rachitha *et al.,* 2023).

Future Directions

The next ten years would bring about the meeting of conventional wisdom and modern systems biology. Nanoformulation of lipophilic compounds (e.g., curcumin) should be considered as a solution to the obstacles of low bioavailability and improved clinical efficacy. Individualised medicine with *Prakriti* (constitutional type) evaluation and genome profiling can enable the prescription of lipid-lowering treatment based on their metabolic profiles. One of the major roles in which the public–private partnership might be instrumental is to fund extensive multicentric trials to produce high-quality evidence. To be incorporated into national guidelines of dyslipidemia management, strong cost-effectiveness studies will be needed to prove that the therapeutic interventions can lower cardiovascular events in the long term. The collaboration of pharmacognosists, clinicians, biostatisticians and regulatory scientists is the key to successful translation of Ayurvedic lipid-lowering interventions to mainstream therapeutics (Gothwal *et al.,* 2023).

Conclusion

The Ayurvedic medicine provides a highly integrative view of lipid disorders, which is in tune with the biochemical concept of dyslipidemia. As demonstrated by phytochemicals, preclinical models, as well as initial clinical trials and studies, botanicals like *Commiphora mukul*, *Berberis aristata*, *Curcuma longa*, *Picrorhiza kurroa*, *Plumbago zeylanica*, *Cyperus rotundus*, and polyherbal preparations such as *Triphala* have therapeutic potential. The effect of these drugs is multitargeted, that is, they disrupt endogenous cholesterol synthesis by HMG-CoA reductase and AMPK to stimulate fatty acid oxidation, bile acid secretion to increase cholesterol clearance, and antioxidant defences to inhibit LDL oxidation. It is all these various modes of action that result in the optimisation of the lipid parameters through the reduction of LDL and triglycerides and the encouragement of an increase in HDL and a decrease in atherogenic risk. In addition to the pharmacodynamics, their plants have good safety and tolerability as well as controlled dosing and therefore can be adopted in the long run-in managing metabolism. Their coincidence with *Rasa Panchaka* concepts also offers a native explanation to constitutional and doshic imbalance in the context of therapeutic choice, which offers a connection of classical thinking and molecular pharmacology. This new evidence makes these agents an option or complementary therapy with great promise, especially to those who cannot tolerate statins or just prefer to have a holistic therapy. The additional progress will rely on the high degree of standardisation of phytoconstituents, multicentric clinical trials, and integration of omics-based network pharmacology to ascertain the synergistic interaction. Combining the traditional Ayurvedic experience with the modern regulatory and scientific justification, the anti-hyperlipidemic solutions developed on the plant basis might be developed into the internationally recognised evidence-based means of dyslipidemia management and cardiovascular complications prevention.

References

1. Ahamad, J., Kaskoos, R. A., Ali, F., & Mir, S. R. (2021). A Critical Review on the Unexplored Therapeutic Treasure of Himalayan Ayurvedic Drug Daruharidra (Berberis Aristata). Current Traditional Medicine, 7(3), 355-361.
2. Ahmad, I., Patel, N., Tyagi, C. K., & Khan, F. (2024). EVALUATION OF ANTI-HYPERLIPIDEMIC ACTIVITY OF LEAVES EXTRACT OF AEGLE GLUTINOSA PLANT.
3. Akhilraj, A. R., & Rukmini, S. (2021). A systematic review on synonyms and properties of Citraka (Plumbago zeylanica Linn. and Plumbago rosea Linn.) from Saṁhitās (Ayurvedic classics) and Nighaṇṭus (Ayurvedic drug lexicons). J Medicinal Plants, 9(3), 33-40.
4. Banerjee, S., Banerjee, S., Bose, S., Das, A., & Mitra, C. (2024). Saussurea lappa (Kushta): An Indian Spice and Its Potential Health Benefits. In Medicinal Spices and Herbs from India (pp. 345-373). Apple Academic Press.
5. Chandran, A., Salvamani, S., Ulaganathan, V., Lim, S. Y., & Gunasekaran, B. (2025). Polyherbal Formulation Approaches for Managing Hypercholesterolemia: Insights from Traditional Chinese Medicine and Ayurveda. Current Traditional Medicine, E22150838314259.
6. Chatterjee, D., Kumar, A., & Singh, I. P. (2024). Qualitative and quantitative studies on the chemical changes during the Ayurvedic detoxification process of Acorus calamus Linn.(Indian Vacha). Phytomedicine Plus, 4(2), 100574.
7. Choudhari, G., Choudhari, V., Pawar, A., & More, C. (2024). Evaluation of antidiabetic, antihyperlipidemic potential and herb-drug interaction of Saptarangi plus Kadha and Saptarangi tablet in streptozotocin-induced diabetic rats. Research Journal of Pharmacy and Technology, 17(5), 2164-2174.
8. Choudhary, S., Kaurav, H., Madhusudan, S., & Chaudhary, G. (2021). Daruharidra (Berberis aristata): review based upon its ayurvedic properties. International Journal for Research in Applied Sciences and Biotechnology, 8(2), 98-106.
9. Das, A., Thanvi, H. A., Jena, N., & Kumar, S. (2025). Phytochemical profiling of fruits of Holoptelea integrifolia (Roxb.) Planch. Plants and Secondary Metabolites, 5.
10. Dewangan, C., Kashyap, R., Patel, S., & Sahu, G. (2025). Acorus Calamus: An Ancient Remedy with Modern Medicinal Applications. International Journal of Scientific Research and Technology.
11. Fuloria, S., Mehta, J., Chandel, A., Sekar, M., Rani, N. N. I. M., Begum, M. Y., ... & Fuloria, N. K. (2022). A comprehensive review on the therapeutic potential of Curcuma longa Linn. in relation to its major active constituent curcumin. Frontiers in Pharmacology, 13, 820806.
12. Ghosh, A., Das, R., Mohanty, J. P., & Roy, S. (2025). An updated review on therapeutic and phytochemical profiling of Acorus calamus Linn. A natural remedy is explored. Journal of Pharmacognosy and Phytochemistry, 14(3), 738-746.
13. Ghosh, S., Murthy, P. N., & Joshi, H. (2021). Different methods of preparation, evaluation, and comparison of a traditional oral liquid formulation for potential antihyperlipidemic activity in hyperlipidemic Wistar rats. Research Journal of Pharmacy and Technology, 14(5), 2426-2433.
14. Gothwal, S., Tomar, B. S., & Chawla, S. K. (2023). Ayurvedic and contemporary views of Vishaghana Mahakashya. Journal of Ayurveda and Integrated Medical Sciences, 8(9), 140-144.

15. HERB, A. P. (2017). International Journal of Ayurveda and Pharma Research. Int. J. Ayur. Pharma Research, 5(5), 47-53.
16. Huddar, S. H., Anupkumar, E., & Jadhav, A. (2023). Classical review of Haridra (Curcuma longa). Journal of Ayurveda and Integrated Medical Sciences, 8(4), 122-127.
17. Jatav, R., Gour, R., & Patel, A. K. (2023). FERONIA LIMONIA NOVEL PLANT: A REVIEW ON HISTORY, GEOGRAPHY, MORPHOLOGY, PHYTOCHEMISTRY, PHARMACOLOGY AND TRADITIONAL USES.
18. Kandikattu, H. K., Amruta, N., Khanum, F., Narayana, V. V. P. C., & Srinivasulu, D. (2022). A review on Cyperus rotundus: ancient weed to modern elixir of life phytochemistry and therapeutic uses of Cyperus rotundus (Mustaka). Pharmaceutical and Biomedical Research.
19. Kaur, S., Singh, S., Anand, N., & Sabharwal, S. (2021). Terminalia Arjuna: A Potential Anti-Hyperlipidemic Drug. Plant Archives, 21(1), 333-337.
20. Khatib, S., Faraloni, C., & Bouissane, L. (2022). Exploring the use of iris species: Antioxidant properties, phytochemistry, medicinal and industrial applications. *Antioxidants*, *11*(3), 526.
21. Kumar, J., & Pundir, M. (2022). Phytochemistry and pharmacology of the Saussurea genus (Saussurea lappa, Saussurea costus, Saussurea obvallata, Saussurea involucrata). Materials Today: Proceedings, 56, 1173-1181.
22. Kumar, M., Bhardwaj, R., Kumar, A., & Kumar, D. (2025). New Insights into the Quality Control Strategies of Inula racemosa Hook. F.(Pushkarmula) and Saussurea lappa Decne.(Kuth): Medicinal Crops of Alpine Himalaya. Journal of Chromatographic Science, 63(2), bmaf009.
23. Kumar, V., Singh, S. B., & Singh, S. (2021). Pharmacological perspectives of ayurvedic herbs, viz. Alstonia scholaris L., Picrorhiza kurroa, Swertia chirata, and Caesalpinia crista against COVID-19: A mini-review. Mini-Reviews in Organic Chemistry, 18(7), 841-849.
24. Mali, S. S., & Shekokar, S. S. (2023). A PHYTOPHARMACOLOGICAL REVIEW OF VALUABLE AYURVEDIC HERB MUSTA-CYPERUS ROTUNDUS LINN.
25. Manpreet, K., Anita, S., & Piyush, G. (2017). Phytochemical and pharmacological study of dhatura: A review. International Journal of Research in AYUSH and Pharmaceutical Sciences, 113-118.
26. Nalla, S., Mathala, N., Sahithi, P. S., Krishna, M. E., Anuradha, N., Sri, P. N. U., & Bhavani, C. (2023). A brief report on hyperlipidemia and its inducing models. Systematic Reviews in Pharmacy, 14(6).
27. Padhar, B. C., Dave, A. R., & Nariya, M. (2021). Acute toxicity and anti-dyslipidemic activity of Arogyavardhini compound in fructose-induced dyslipidemia in albino rats. Indian Journal of Natural Products and Resources (IJNPR)[Formerly Natural Product Radiance (NPR)], 12(3), 384-390.
28. Panda, V., Deshmukh, A., Singh, S., Shah, T., & Hingorani, L. (2021). An Ayurvedic formulation of Emblica officinalis and Curcuma longa alleviates insulin resistance in diabetic rats: involvement of curcuminoids and polyphenolics. Journal of Ayurveda and Integrative Medicine, 12(3), 506-513.
29. Pasam, S., Pragada, V. R., Bakshi, V., & Boggula, N. (2023). Cyperus Rotundus L. Plant in Traditional Medicine: A Review. Journal of Advancement in Pharmacognosy, 3(1), 7.
30. Pathak, K., Das, A., Shakya, A., Saikia, R., & Sarma, H. (2021). Evaluation of Anti-Diabetic and Anti-Hyperlipidemic Activity of Isolated Bioactive Compounds of Leaves of Annona reticulata Linn. The Natural Products Journal, 11(3), 414-421.
31. Prakash, J., Singh, D. C., Vashisht, K., Rawat, N., & Rawat, K. (2023). COMPREHENSIVE REVIEW OF ATIVISHA–ACONITUM HETEROPHYLLUM.
32. Pundir, M., Singh, C., Adlakha, M. K., & Gocher, G. (2024). A COMPREHENSIVE REVIEW ON THE CONCEPT OF PANCHAMAHABHUTA SIDDHANT AND DRUG ACTION IN AYURVEDA.
33. Rachitha, P., Krishnaswamy, K., Lazar, R. A., Gupta, V. K., Inbaraj, B. S., Raghavendra, V. B., ... & Sridhar, K. (2023). Attenuation of hyperlipidemia by medicinal formulations of Emblica officinalis synergised with nanotechnological approaches. Bioengineering, 10(1), 64.

34. Rahmat, S., Mannan, A. B., Prottasha, M. K., Shakil, F. A., Shawon, S. J., Nafsan, M. N. R., & Chowdhury, M. M. (2024). Hepatoprotective and Anti-hyperlipidemic Effects of Ethanolic Extract of Terminalia arjuna in a High-fat-induced Hyperlipidemic Rat Model. Asian Journal of Advanced Research and Reports, 18(9), 200-209.
35. Raina, D., Raina, S., & Singh, B. (2021). Katuki (Picrorhiza Kurroa)-A promising Ayurvedic Herb. Biomed J Sci Tech Res, 36(1), 28238-28242.
36. Rana, S., Palatty, P. L., Benson, R., Kochikuzhyil, B. M., & Baliga, M. S. (2022). Evaluation of the anti-hyperlipidemic effects of Triphala in high-fat diet-fed rats: Studies with two combinations. AYU (An International Quarterly Journal of Research in Ayurveda), 43(3), 98-104.
37. Sahu, N., Bansal, C., & Zainab, S. (2023). A Critical Review on the Impact of Ayurvedic Dietetics (Pathya Apathya) in the Management of Dyslipidemia. International Journal of Ayurveda and Pharma Research, 33-38.
38. Saklani, S., Yadav, S., Bisht, G., Rishishwar, S., & Rishishwar, P. (2024). PHARMACOTHERAPEUTIC USES OF MEDICINAL AYURVEDIC HERB DARUHARIDRA (BERBERIS ARISTATA): AN UPDATED REVIEW.
39. Sethi, H. K., & Gupta, R. (2023). A clinical study to evaluate the efficacy of Vacha (Acorus calamus) in the management of Sthaulya with special reference to Hyperlipidemia. Journal of Ayurveda and Integrated Medical Sciences, 8(2), 30-38.
40. Sheik, S. M., Bakthavatchalam, P., Shenoy, R. P., Hadapad, B. S., Nayak, D., Biswas, M., & Suryakanth, V. B. (2022). Anti-hyperglycemic, anti-hyperlipidemic, and anti-inflammatory effect of the drug Guggulutiktaka ghrita on high-fat diet-induced obese rats. Journal of Ayurveda and Integrative Medicine, 13(3), 100583.
41. Singh, B., Rastogi, R., Singh, L. R., Singhal, A., & Singh, R. (2025). An analytical study of Kalmegh (Andrographis paniculata) and Kiratikta (Swertia chirayita): an economic substitution for metro cities in the global pandemic with Healthcare 4.0. International Journal of Sustainable Society, 17(2), 113-140.
42. Talreja, S., & Tiwari, S. (2023). A comprehensive review of Aconitum heterophyllum. Journal of Ayurveda and Integrated Medical Sciences, 8(10), 195-201.
43. Tanwar, A. K., Chatterjee, D., Jain, N., Sharma, S., Tikoo, K., & Singh, I. P. (2025). Chemical basis of the traditional ayurvedic detoxification process of the toxic medicinal plant Plumbago zeylanica. *Journal of Natural Products*, *88*(1), 15-23.
44. Tiwari, A., Shukla, A., & Kumar Samal, P. (2025). Evaluation of Anti-Hyperlipidemic and Anti-Atherogenic Activity of Asiatic Acid and Its Effect on Lipid Peroxidation in Hyperlipidemic Rats. Journal of Biochemical and Molecular Toxicology, 39(5), e70255.
45. Tyagi, T., Sharma, S., & Sharma, R. (2022). EVIDENCE-BASED CLASSICAL AND ETHANOMEDICINAL REVIEW ON HOLOPTELEA INTEGRIFOLIA (ROXB.) PLANCH.(CHIRABILVA).
46. Upadhyay, R. K. (2021). Antihyperlipidemic and cardioprotective effects of plant natural products: A review. International Journal of Green Pharmacy (IJGP), 15(1).
47. Vikhe, S., Kunkulol, R., & Raut, D. (2023). In Silico and In Vivo Studies of Decursin Isolated From the Ethanolic Extract of Feronia elephantum Correa (Rutaceae) Bark as a Potential Antidiabetic and Antihyperlipidemic Agent in STZ-induced Diabetic Rats. *Letters in Drug Design & Discovery*, *20*(5), 517-535.
48. Wani, T. A., Kaloo, Z. A., & Dangroo, N. A. (2022). Aconitum heterophyllum Wall. ex Royle: A critically endangered medicinal herb with rich potential for use in medicine. Journal of Integrative Medicine, 20(2), 104-113.
49. Yadav, N., & Singh, A. K. (2023). Amalaki (Emblica officinalis Gaertn.): A review on its therapeutic properties. Journal of Ayurveda and Integrated Medical Sciences, 8(8), 155-162.