

An updated review on Antihyperlipidemic Medicinal Plants

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ABSTRACT

The biggest risk factor for coronary heart disease is hyperlipidemia. Currently, a lot of negative effects have been linked to allopathic antihyperlipidemic medications. Herbal treatment for hyperlipidemia is inexpensive, readily available locally, and has no negative side effects. The "backbone" of traditional medicine, medicinal plants are regarded as a good source of life for all people due to their wealth of curative characteristics and complete naturalness. Traditional medical practises that heavily rely on plants, herbs, and shrubs have always been an integral part of the world health system. The demand for herbal drugs is growing since natural products are generally less harmful, have less adverse effects, and are more readily available. The goal of the review paper is to examine the potential antihyperlipidemic effects of herbal plants using a variety of models. The anti-hyperlipidemic activity of the most well-known medicinal herbs is the focus of this review.

Keywords: Hyperlipidemia, phytochemicals, herbal drugshypolipidemic agents, hypolipidemic medicinal plants

I. INTRODUCTION

The word "hyperlipidemia" refers to unusually high amounts of lipids (fats), which include triglycerides and cholesterol, in the blood. Although hyperlipidemia can be inherited, lifestyle choices such as an imbalanced diet and insufficient exercise are more frequently to blame. High cholesterol hyperlipidemia is the most prevalent form. Hypertriglyceridemia and mixed hyperlipidemia, which has high levels of both triglycerides and cholesterol, are further types of hyperlipidemia. Particularly in contemporary wealthy nations, hyperlipidemia is a widespread condition. Additionally, it's rising everywhere. Obesity has drastically increased in recent years. The modern lifestyle, which is defined by a bountiful supply of nutrients and minimal physical activity, has led to a substantial increase in obesity-associated illnesses and metabolic syndromes, including obesity, dislipidemia, diabetes, and

cardiovascular disease. Extraordinary dietary fat, which contributes to the accumulation of excessive body fat, is one of the most important environmental factors associated with obesity. White adipose tissue (WAT), an important site of energy storage, releases stored energy as free fatty acids when calorie intake is low and stores it as triglycerides when calorie intake is high. Even though WAT gives you a survival advantage when you're starving, it's now known that consuming too much of it can lead to health problems associated with obesity.

HYPERLIPIDEMIA CAUSING AGENTS

Medications that are helpful for some problems can make your cholesterol levels fluctuate, such as: beta-blockers, diuretics, hormonal birth control, steroids, and antiretroviral drugs for HIV. Several causes of hyperlipidemia include: Smoking, having a large alcohol intake, consuming meals that are high in trans or saturated fats, sitting down too much and not moving around, feeling tense, having unhealthily high cholesterol due to genetics, weighing too much.

Antihyperlipidemic Medicinal Plants

The use of medicinal plants as a rich resource for bioactive disease prevention and treatment strategies is highly regarded throughout the world. The prehistoric medical system, in which only soothing therapy is still offered, also listed plant cures for avoiding and maintaining anarchy to hyperlipidemia, hyperglycemia, immunological systems, and other aging-related disorders that are not curable with medicinal treatments. The current survey is intended to gather data based on published studies on phytochemicals from medicinal plants that have been tested for antihyperlipidemic properties.

The following plants exhibit antihyperlipidemic properties:

Asparagus racemosus

The Liliaceae family includes the significant therapeutic herb *Asparagus racemosus*. It is widely grown in tropical and subtropical areas

including India, Australia, Asia, and Africa under the trade name "Satavari." *A. racemosus* is referred to as "Satomul" locally in Assam. As it is known to treat a number of illnesses, including tumours, hepatopathy, dyspepsia, infectious diseases, and ulcers, it is frequently employed in traditional medicine preparations. Regarding hepatoprotective, immunomodulatory, and anti-inflammatory properties, there are few publications available (Alok et al., 2013). In hyperlipidemic rats, Bhosale et al. (2012) examined the lipid-lowering potential of asparagus racemosus. When *A. racemosus* dry powder was given to rats in doses of 5 gm% and 10 gm%, it significantly reduced plasma cholesterol, LDL, oxidative stress, and increased HDL in hyperlipidemic conditions. [2,5]

Aegle marmelos

The Indian subcontinent's inhabitants have employed the indigenous plant *aegle marmelos*, often known as "Bael," for over 5000 years (Baliga et al., 2011). Locally called as "Bel" in Assamese, it is valued for its medicinal properties and holds a special place in conventional medical systems. In high cholesterol-induced hyperlipidemic rats, Sinha and Ghosh (2015) examined the anti-hyperlipidemic effects of *Aegle marmelos* (leaves) and *Terminalia arjuna* (bark). The serum cholesterol and triglycerides levels were significantly decreased after oral administration of both extracts, which had a strong anti-hyperlipidemic effect. Porchelvan & Venkatakrishnamurali (2014) looked into the effects of chronic oral administration of *Aegle marmelos* leaf extracts and entire leaf powder for 90 days in male Wistar rats. Serum cholesterol, TG, VLDL, and LDL all significantly decreased as a result of the investigation. However, there has also been a noticeable rise in HDL. [3,12]

Baccaurea ramiflora

The Euphorbiaceae family includes *Baccaurea ramiflora*, more often known as "Burmese grape," a slow-growing tree. In high fats-induced Wistar albino rats, the ethanolic extract of *B. ramiflora* (seeds) was tested for its ability to reduce hyperlipidemia. Orally administered doses were 150, 250, and 500 mg/kg (body weight). Significant drops in blood TC, TG, and LDL-C levels have been observed, and the dose of 500 mg/kg of *B. ramiflora* (seed) ethanolic extract is thought to be the most beneficial. This demonstrates the seed extract's hypolipidemic efficacy against dietary-induced hyperlipidemia (Alam et al., 2019). [1,10]

Caraca papaya

Caraca papaya is well known for its therapeutic and dietary benefits. It's a member of the Caricaceae family. It is also regarded as a strong contender for the treatment of dengue (Charan et al., 2016). In albino Wistar rats fed a high-fat diet for five weeks, the aqueous extract of *C. papaya* seed was tested for its ability to reduce hyperlipidemia. The levels of TC, TG, and LDL in treated rats at doses of 200 mg/kg/day and 300 mg/kg/day were significantly reduced. However, it was noted that HDL had increased somewhat. These findings indicate that *C. papaya* seed extract has hypolipidemic properties (Nwangwa & Ekhoeye, 2013).

Cassia angustifolia

Anti-hyperlipidemic activity was evaluated using Triton X 100-induced Hyperlipidemia in rats as an experimental model. To evaluate the hypolipidemic activity, plasma triglycerides, total cholesterol, HDL, LDL, and VLDL were measured. The 400 mg/kg dose of EECA demonstrated a substantial hypolipidemic impact (P 0.01), and the 300 mg/kg dose was likewise significant across the board for the criterion used to assess the hypolipidemic effect (P 0.05). The hypolipidemic action of *Cassia angustifolia*'s ethanolic extracts was demonstrated, and this study offers empirical support for its traditional claims. However, more research is required to fully comprehend the mechanism [18].

Cinnamomum tamala

Cinnamomum tamala belongs to family of Lauraceous. *Cinnamomum* leaf extracts' hypolipidemic effects in high-cholesterol diet-induced hyperlipidemia. In rat models with hyperlipidemia caused by a cholesterol-rich diet, research on the anti-hyperlipidemic effects of aqueous and ethanolic extracts of *Cinnamomum tamala* leaves was conducted. Treatment of hyperlipidemic rats with an aqueous and an ethanol extract of *Cinnamomum tamala* leaves in doses of 400 mg/kg/day p.o. each for 10 days with a cholesterol diet results in a significant decrease in serum levels of total cholesterol, triglyceride, LDL-C, VLDL-C, and atherogenic index, while also showing a significant increase in HDL-C levels [19].

Curcuma longa

The perennial herb *Curcuma longa* is a member of the Zingiberaceae family. *Cucuma longa* and atorvastatin both have

antihyperlipidemic effects on albino rats, according to Jogdand & Padhye's evaluation and comparison in 2019. Obese rats were given an oral dose of the ethanolic extract of *C. longa* for 8 weeks, and there was a significant decrease in serum TC and serum TG, demonstrating turmeric's hypolipidemic effect. [6]

Emblica officinalis

Amla, also known as *Emblica officinalis*, is one of the significant medicinal herbs with numerous therapeutic benefits. It is a member of the Euphorbiaceae family and is locally referred to as "Amlakhi" in Assam. The plant's extract is thought to be helpful for treating a variety of illnesses, including neurological disorders, inflammatory conditions, hypertension, parasitic conditions, and other infectious diseases (Variya et al., 2016). In sixty type II hyperlipidemic patients, Bhatt et al. (2012) compared the hypolipidemic efficacy of *Emblica officinalis* (Amla) to that of the HMG-CoA reductase inhibitor simvastatin. For 42 days, 40 of the patients received treatment with 500 mg of *E. officinalis* capsules, whereas 20 of them received simvastatin capsules (20 mg). Treatment with *E. officinalis* resulted in a notable reduction in TC, TG, LDL, and VLDL as well as a respectable increase in HDL. Significant effects were seen with both therapies. However, this beneficial effect was more pronounced in patients who received *E. officinalis* treatment. [4,14]

Glycyrrhiza glabra

The herbaceous plant *Glycyrrhiza glabra*, also known as licorice, is indigenous to Europe and Asia. It can be found throughout Northeast India and is locally called as "Jesthimadhu" in Assam. Due to its antibacterial, antiviral, anti-allergic, antidiabetic, hepatoprotective, and anti-carcinogenic properties, this plant has historically been used as medicine (Pastorino et al., 2018). Shamim et al. (2016) tested the impact of an ethanolic extract of *Glycyrrhiza glabra* against streptozotocin- and high-fat diet-induced diabetes and hyperlipidemia in rats. While the group pre-treated with extract of *Glycyrrhiza glabra* exhibited a substantial drop in biochemical markers including Total cholesterol (TC), Triglyceride (TG), and High-density lipoprotein, the diabetic rats fed with a high fat diet (D-HFD) showed a rise in serum cholesterol and LDL-C. (HDL). High density lipoprotein (HDL), which inhibits the pathogenesis of atherosclerosis, is also significantly elevated (Boden and Pearson, 2000). [11]

Hibiscus cannabinus

Known as kenaf, *hibiscus cannabinus* is a perennial herb. According to claims, the monounsaturated and polyunsaturated fatty acids (PUFAs) found in *H. cannabinus* seed oil have the ability to decrease cholesterol (Nyam et al., 2009). Its Assamese name for it is "Meseka tenga" (Barua et al., 2007). For 32 days, male Sprague-Dawley rats were used to test the anti-hyperlipidemic effects of kenaf seed oil, microencapsulated kenaf seed oil, kenaf seed extract, and defatted kenaf seed meal. Because of the considerable reduction in serum TG and TC, kenaf seed extract demonstrated strong cholesterol reducing effects. In light of this, kenaf seed extract can be utilised as a natural alternative to synthetic hypolipidemic medications (Kai et al., 2015). [7]

Ipomoea aquatica

Convolvulaceae is a family of tropical plants that includes the semi-aquatic plant known as *Ipomoea aquatica* (Water spinach). It is a traditional and powerful medicinal plant that is effective in treating nervous and general female debility in Assam, as well as fever, jaundice, bronchitis, and liver sickness (Manvar & Desai, 2013). *Ipomoea aquatica*'s methanolic extract was tested for its ability to lower blood cholesterol levels in hyperlipidemic rats as well as its mechanism of action. *Ipomoea aquatica* leaf extract in methanol was given to rats in doses of 200 mg/kg and 400 mg/kg for 30 days. The plasma content of total cholesterol, total lipid, free fatty acid, phospholipid, and triglycerides were significantly lower in the rats' blood after receiving either dosage of *I. aquatica* extract, according to blood analysis. These findings provide pharmacological support for folkloric assertions that methanolic extract of *I. aquatica* may have potential anti-hyperlipidemic effect (Sivaraman & Muralidaran, 2010) [8, 13]

Mimosa pudica

The hypolipidemic activity of *Mimosa pudica* extract was studied on high fat diet induced models of hyperlipidemia in rats. An increase in cholesterol, triglyceride, LDL, and VLDL levels in experimental rats served as evidence of hyperlipidemia. By significantly reducing the serum levels of biochemical parameters like cholesterol, triglycerides, low-density lipoproteins, and very low-density lipoproteins while also raising HDL levels, ethanol extract demonstrated a significant hypolipidemic effect that was

comparable to that of the widely used drug Lovastatin.[20]

Moringa oleifera

The impact of *Moringa oleifera* aqueous leaf extract on male albino rats' plasma glucose, total cholesterol, triglycerides (TG), high-density lipoprotein (HDL), and low-density lipoprotein (LDL) levels Alloxan monohydrate at a dose of 100 mg/kg was used to cause diabetes. While the diabetic treatment group received 400 mg/kg of *M. oleifera* aqueous leaf extract daily for 28 days, the control and diabetic groups received distilled water. After a 12-hour fast, the plasma glucose level, cholesterol, TG, high-density lipoprotein (HDL), and low-density lipoprotein (LDL) of all the experimental animals were measured at the conclusion of the study. The plasma cholesterol, TG, and LDL levels all increased significantly as a result. Aqueous *M. oleifera* leaf extract taken orally may help to balance out the plasma lipid levels.[21]

Morus alba

Morus alba (L.) has been well researched for its several health advantages, including hypolipidemia, antihyperglycemia, and antiatherogenic properties (Harauma et al., 2007). Chen et al. (2007) investigated the anti-hyperlipidemic properties of flavonoids from *M. alba* leaves in triton WR-1339-induced hyperlipidemic mice. This study demonstrated that mulberry leaf-derived flavonoids can prevent WR-1339 from altering serum lipid levels. A notable decrease in TC and TG suggested the presence of hypolipidemic activity. Chen et al. (2007) investigated the anti-hyperlipidemic properties of flavonoids from *M. alba* leaves in triton WR-1339-induced hyperlipidemic mice. This study demonstrated that mulberry leaf-derived flavonoids can prevent WR-1339 from altering serum lipid levels. A notable decrease in TC and TG suggested the presence of hypolipidemic activity. [16,17]

Terminalia Arjuna

For the treatment of diabetes, heart disease, leucorrhea, and cholesterol lowering, *Terminalia arjuna*'s bark is employed. The study examined the anti-hyperlipidemic properties of a 50% ethanol extract of *T. arjuna* bark in hyperlipidemic rats caused by a cholesterol-rich diet. The treatment of hyperlipidemic rats with a 50% v/v ethanol bark extract at a dose of 40mg/kg body weight along with a cholesterol diet resulted in a significantly lower level of serum total cholesterol (TC), triglycerides (TG), low density lipoprotein (LDL),

and very low density lipoprotein (VLDL), while the experimental group's HDL cholesterol increased [22].

Withania somnifera

Withania somnifera, also known simply as "Ashwagandha," is a significant medicinal plant that has been utilised for thousands of years in both traditional and Ayurvedic medicine. The pharmacological properties of ashwagandha have been the subject of numerous pharmacological research. This plant has been the subject of numerous studies, and the results suggest that it has anti-inflammatory, anti-tumor, anti-stress, antioxidant, immunomodulatory, hemopoietic, and rejuvenating effects (Mishra et al., 2000). In a 2007 study, Visavadiya & Narasimhacharya examined the hypocholesterolemic effects of *Withania somnifera* root powder in male albino rats. The plasma levels of total lipids (-40.54 %; -50.69 %), cholesterol (-41.58%; -53.01 %), and triglycerides (-31.25%; 44.85%) significantly decreased in the hypercholesterolemia-induced group administered root powder at 0.75 and 1.75 gm/rat/day. On the other hand, the fact that these animals had increased plasma HDL cholesterol levels, HMG-CoA reductase activity, and liver bile content suggests that they have anti-hyperlipidemic activity. [9,15]

II. CONCLUSIONS:

Unusual high levels of lipids, raised serum levels of total cholesterol, low-density lipoprotein cholesterol, triglycerides, or both total cholesterol and total triglycerides (combined hyperlipidemia), and very low density lipoprotein are all symptoms of hyperlipidemia [23]. A lifestyle issue called hyperlipidemia has a negative impact on people's health [24]. It causes a number of cardiovascular conditions, including congestive heart failure, atherosclerosis, hypertension, angina pectoris, and myocardial infarction [25]. This article provides a summary of a few medicinal plants with notable anti-hyperlipidemic properties that could be used as preventative treatments for conditions including heart diseases and hyperglycemia. From this review, it can be inferred that a great number of plants have powerful anti-hyperlipidemic properties, and a great number more are yet to be discovered.

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