



Hyperlipidemia – A Systematic Review

*Akanksha D. Bhosle*¹, *Mr. Rushikesh S. Sarde*²

¹ student of B pharmacy final year, ² Assist. Professor . Department of Chemistry , Latur college of Pharmacy, Hasegaon

ABSTRACT:

Hyperlipidemia is a growing concern in both developed and developing countries, including India, due to its high blood fat levels. This ailment, often referred to as the “silent killer,” has become particularly rampant due to it increasing the odds of viscous heart ailments and atherosclerosis. Herbal products for hyperlipidemia treatment can be procured from nearby locations and are affordable while having no negative implications on one’s health. These products can be purchased conveniently and oftentimes do not result in side effects, making them an attractive option. For centuries, traditional medicine has appreciated and emphasized the use of plants due to their multitude of benefits towards health. Several medicinal herbs have documented efficacy in the Siddha system of medicine for cholesterol reduction without serious side effects. Guggul, garlic, ashwagandha, and arjuna are all well-known to reduce cholesterol. This review aims to explore through various scientific studies the possible value of these and other herbal plants for the alleviation of hyperlipidemia.

Keywords: hyperlipidemia, arjuna, ashwagandha, garlic, guggul

Introduction:

Elevated lipid levels in the human body are referred to as hyperlipidemia, a condition that includes a number of hereditary and acquired conditions. Throughout the world, but particularly in the Western hemisphere, hyperlipidemia is very prevalent. In contrast, a more objective definition of hyperlipidemia is defined as total cholesterol, triglyceride, lipoprotein, or low-density lipoprotein (LDL) levels that are higher than the 90th percentile relative to the general population, or HDL levels that are lower than the 10th percentile relative to the general population. Cholesterol, lipoproteins, chylomicrons, VLDL, LDL, apolipoproteins, and HDL are examples of lipids. Expanded ranges of LDL cholesterol have consistently been shown to raise an individual’s risk of developing atherosclerotic plaques and the vascular disease that follows through a wide range of trials and studies. The LDL cholesterol goal of each patient depends on their individual cardiovascular risk, and each affected person needs a scientific solution that is customized for them. Atherosclerotic cardiovascular disease can be prevented by managing risk factors, such as hyperlipidemia, which is known as “number one prevention.” The rationale behind lowering LDL cholesterol comes from extensive epidemiologic data showing a positive, ongoing relationship between LDL cholesterol levels and cardiovascular events.

Lipoproteins in plasma.

The following kinds of lipoproteins carry water-insoluble plasma lipids.

These include: chylomicrons; HDL (lipoprotein of high density), LDL (lipoprotein of low density), chylomicron remnants, VLDL (very low density lipoprotein), and IDL (intermediate density lipoprotein).

Lipid	Desirable level (Low risk)	Abnormal level (High-risk)
Total cholesterol	<200	>240
LDL cholesterol	<130	>160
HDL cholesterol	>60	<40
Triglycerides	<200	>400

Fig 1 Lipid chart

Epidemiology

There are already over three million persons in the US and Europe who have been diagnosed with hyperlipidemia, and the number is rapidly increasing. Usually a chronic, progressive condition, hyperlipidemia necessitates dietary and lifestyle modifications as well as the possible need for additional lipid-lowering drugs. Patients with premature coronary artery disease (CAD), which is defined as CAD that develops in males before the age of 55 to 60 and in females before the age of 65, have the highest degree of hyperlipidemia. The incidence of hyperlipidemia is approximately 75–85% under the previously mentioned conditions, compared to approximately 40–48% in the control group of similar age, but without early coronary artery disease. Over 50% of American individuals are estimated to have raised LDL levels, and it is hypothesized that less than 35% of those patients effectively control their higher LDL levels, indicating a disease that is not receiving enough treatment. According to the JAMA Network, "The prevalence of dyslipidemia was significantly higher among men than women ($P \leq .02$ in all ethnic groups) and among whites than blacks (women, 64.7% vs. 49.5%; and men, 78.4% vs. 56.7%; $P < .001$ for both)."

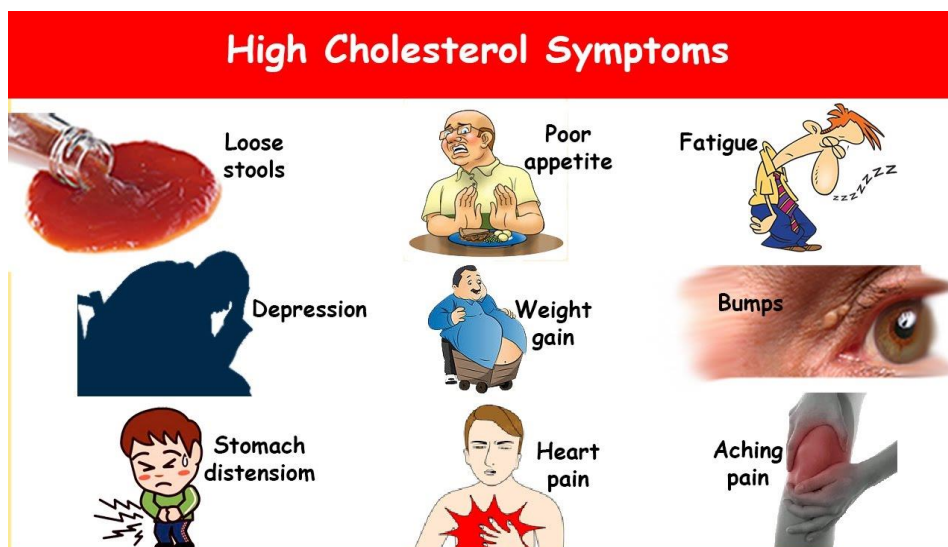


Fig 02 symptoms

CLASSIFICATION OF HYPERLIPIDEMIA

1. Regarding the theory of causation

1. Primary (family: hyperlipidemia)

Due to a genetic disease, it is also known as familial; it can be polygenic, meaning it has several gene faults, or monogenic, meaning it is an unmarried gene condition. One of the common lipoprotein patterns can typically be used to resolve primary hyperlipidemia.

type I: elevated triglyceride levels and cholesterol.

type II: high cholesterol along with normal triglyceride levels.

Type III: Elevated triglycerides and cholesterol

type IV: Elevated uric acid, atheroma, and triglycerides.

Triglycerides of type V are elevated.

2. Acquired hyperlipidemia, or secondary

Because it is brought on by other conditions including diabetes, glomerular syndrome, long-term alcohol consumption, hypothyroidism, and the use of medications like beta-blockers, corticosteroids, and oral contraceptives, it is acquired. Pancreatitis may result from secondary hyperlipidemia and severe hypertriglyceridemia.

2. Regarding the concept of lipid type

1. Hypercholesterolemia: This condition is characterized by an increased cholesterol level.

2. Hypertriglyceridemia: characterized by high triglyceride levels.

CAUSES

1.nutritional factors

• excessive consumption of saturated fat: Diets wealthy in saturated fat, such as those determined in beef, dairy merchandise, and processed foods, boom low-density lipoprotein. Trans fatty acids, which are frequently found in margarine, baked goods, and fried foods, raise LDL cholesterol while lowering HDL (the "precise") LDL cholesterol. • immoderate alcohol consumption: continual alcohol consumption can result

in increased triglyceride ranges, contributing to hyperlipidemia.

2. obesity

• obesity, mainly belly weight problems, is related to excessive stages of LDL ldl cholesterol and triglycerides. The excess fat inside the body interferes with lipid metabolism and increases the hazard of hyperlipidaemia .

3. Genetic elements

• Familial Hypercholesterolemia: A genetic disorder that leads to very high levels of LDL ldl cholesterol due to mutations inside the LDL receptor gene. individuals with this situation are at excessive chance for premature cardiovascular sicknesses (Goldstein & Brown, 2009).

• Polygenic hypercholesterolemia: A greater common form, regarding more than one gene contributing to mild to slight elevation of levels of cholesterol.

4. lack of bodily activity

• Sedentary behaviour reduces the capacity of the frame to control and regulate lipids. everyday bodily pastime facilitates to boom HDL cholesterol and reduce triglycerides and LDL ldl cholesterol (American coronary heart affiliation, 2020).

5. Age and Gender

• As people age, lipid degrees, particularly LDL ldl cholesterol and triglycerides, generally tend to upward thrust. additionally,

postmenopausal women often revel in an growth in total cholesterol and LDL stages due to decreased estrogen tiers (Meschia et al., 1999).

6. strain

• persistent pressure can increase the manufacturing of cortisol, which in flip raises triglyceride tiers and disrupts lipid metabolism (Steptoe et al., 2007)

ANTI-HYPERLIPIDEMIC DRUGS

1)Cinnamon

Synonym- Cinnamon bark, Kalmi – Dalchini Ceylon cinnamon.

Biological Source- The biological source of cinnamon is the dried inner bark of the shoots of compiled trees of *Cinnamomum zeylanicum* Nees (*Cinnamomum verum* J.S. Presl).

Family- Lauraceae.

Chemical Constituents - It incorporates Calcium oxalate, Mucilage, 1.2% of Tannins, zero.5-1.0% of volatile oil (active constituent, mild yellow in clean, modifications to red on storage.), Starch and Mannitol. The Cinnamon oil consists of five-10% eugenol, benzaldehyde, cuminaldehyde, 60-70% of Cinnamaldehyde and different Terpenes consisting of pinene, Cyrene, Caryophyllene

Mechanism of action: The main active components of cinnamon, cinnamonaldehyde, cinnamic acid, and other polyphenols like procyanidins and catechins, are believed to have potential lipid-lowering effects in the context of hyperlipidemia. These compounds' anti-inflammatory and antioxidant properties may aid in lipid level regulation. Particularly, cinnamonaldehyde has been studied for potential impacts on lipid metabolism, cholesterol synthesis, and insulin sensitivity.

Uses & Effectiveness-. In a variety of culinary preparations, such as tea, breakfast, snacks, and traditional cuisine, it is primarily used as an aromatic spice and flavoring agent. It is also known as cinnamon bark, Kalmi Dalchini, and Ceylon cinnamon. In spite of this, it is used as a medicinal herb in Ayurveda.

Oral administration side effects: Ceylon cinnamon is commonly used in cooking. It may be safe to use as a medication. Doses of 0.5–3 grams daily have been successfully used for up to 6 months.

Dosage: Three grams of Ceylon cinnamon are usually taken orally by adults every day. It has also been used in nasal sprays and mouthwashes.

Contraindication Cinnamon does not respond with the maturity of specifics when taken in small to moderate amounts. However, if you are taking medication for diabetes, heart disease, or liver disease, consuming too much could be harmful.

Fig 03 – Chemical structure of Cinnamaldehyde

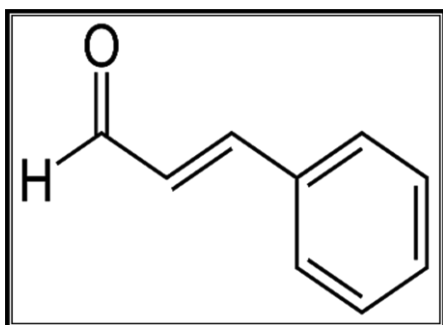


Fig 04 - Cinnamon



Interaction -Ceylon cinnamon interacts with anti-diabetic and diabetes medications and may lower blood sugar levels. Ceylon cinnamon may cause blood sugar levels to fall dangerously low when taken by people with diabetes. Observe your blood sugar levels carefully.

b. Ceylon cinnamon may lower blood pressure by interacting with antihypertensive medications, which treat high blood pressure. An extremely low blood pressure reading could result from using Ceylon cinnamon with blood pressure-lowering medications. Observe your blood pressure closely.

Storage-It's essential to store medications containing cinnamon in a cool, dry place away from direct sunlight. Follow the specific instructions on the medication's packaging for optimal storage conditions.

2] Arjuna

Synonym- Aartagala, Indravriksha, Paartha, Virataru, Viravriksha, Dhananjaya, Kaakubha, and Kakubha.

Biological Source-Arjun consists of dried stem bark of the plant known as Terminalia arjuna Rob.

Family- Combretaceae.

Chemical elements- Arjun contains approximately 15 percentage of tannins (hydrolysable). It additionally carries triterpenoid saponin, arjunolic acid, arjunic acid, arjungenin. similarly, it consists of beta sitosterol, ellagic acid and arjunic acid.

Mechanism of action- In Arjuna (Terminalia arjuna), the primary active ingredients that are believed to make a contribution to its capacity consequences on hyperlipidemia include triterpenoid saponins like arjunic acid and arjunolic acid, flavonoids, tannins, and glycosides. these compounds possess antioxidant and cardioprotective houses that would resource in coping with lipid levels. studies advocate that Arjuna extracts can also assist in reducing total cholesterol, LDL cholesterol, and triglycerides at the same time as increasing HDL cholesterol. these consequences may be attributed to their ability to influence lipid metabolism enzymes, showcase antioxidant moves, and doubtlessly modulate cholesterol synthesis

Uses and Effectiveness –

1. Arjuna for Angina: Arjuna is helpful in treating chest discomfort. According to studies, Arjuna bark significantly reduces chest pain by reducing cortisol levels, which are an indication of stress. In those with stable angina, arjuna also lowers blood pressure, raises exercise tolerance, and enhances HDL levels.

2. Arjuna for Heart Disease: Because it strengthens the heart muscles and serves as a cardiogenic, arjuna may help manage heart disorders. Certain components found in Arjuna bark, like as tannins and glycosides, have antioxidant qualities that save the heart's muscles and blood vessels from harm brought on by free radicals. Additionally, Arjuna aids in blood vessel dilatation and plaque dissolution to enhance blood flow. As a result, it works well to treat cardiac issues such elevated blood pressure, palpitations, and fast heartbeat.

3. Using Arjuna for Diarrhea: Arjuna may help treat diarrhea. Arjuna contains some components that have astringent and antibacterial qualities. Additionally, it possesses antibacterial properties that help treat intestinal infections brought on by microbes. It controls intestinal motility and stops the body from losing too much water and electrolytes.

4. Arjuna for Airway Inflammation (Bronchitis): Arjuna helps treat lung conditions like bronchitis, asthma, coughing, and infections. According to Ayurveda, poor digestion is the root cause of lung issues like bronchitis, which are referred to as Karonga. Ama, or poisonous residues in the body as a result of incorrect digestion, is created by poor food and insufficient waste removal. This Ama causes bronchitis when it builds up in the lungs as mucus. Because of its ability to balance Kapha, taking Arjuna aids in reducing Ama and removing mucus.

5. Arjuna for Urinary Tract Infections (UTIs): Arjuna helps treat UTIs because of its antibacterial qualities. Arjuna also treats problems like frequent urination.

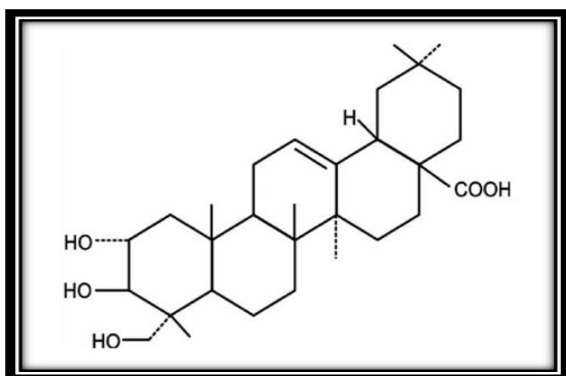


Fig 05 – Chemical Structure of Arjunolic Acid.



Fig 06 - Arjuna

Adverse Reactions -Terminalia arjuna may be safe to take orally for a maximum of three months. However, utilize Terminalia arjuna only under a doctor's supervision. It may have an impact on your heart.

Dosage- Adults have most frequently taken 500 mg of Terminalia arjuna orally three times a day for up to three months. Adults have most frequently taken 200 mg of Terminalia chebulia orally two to three times a day for up to three months. There isn't enough trustworthy data to determine what Terminalia billerica dosage is suitable. Remember that the heart can be affected by terminalia.

Contraindication -TERMINALIA ARJUNA interacts with anticoagulant and antiplatelet medications, which inhibit blood clotting. Blood clotting may be slowed by Terminalia arjuna. Bruising and bleeding may become more likely if Terminalia arjuna is taken with drugs that also inhibit blood coagulation.

Interactions

- TERMINALIA ARJUNA interacts with medications that reduce blood clotting, such as anticoagulant and antiplatelet medications.
- TERMINALIA ARJUNA interacts with medications that are altered by the liver (Cytochrome P450 2C9 (CYP2C9) substrates).
- Drugs that are altered by the liver (substrates of cytochrome P450 2D6; CYP2D6) interact with TERMINALIA ARJUNA.
- TERMINALIA ARJUNA interacts with medications that are altered by the liver (substrates of CYTochrome P450 3A4 (CYP3A4)).

3] Garlic

Synonyms- Allium sativum, Ail, Ail Cultive, Alho, Allium, Allium sativum, Anglo D'India, Black Garlic.

Biological constituent-This consists of bulbs of the plant known as Allium sativum Linn.

Family- Alliaceae.

Chemical constituent- Allicin (yellowish liquid), alliin, mucilage, albumin, alpha-glutamyl peptides, volatileoils, amino-acids as: methionine, cysteine, lucine, vitamin C. Garlic powder is 73% carbohydrates (including 9% dietary fiber), 17% protein, 1% fat, and 6% water.

Mechanism of Action- Garlic contains various sulfur-containing compounds, with allicin being one of the primary active components. Allicin is believed to have potential effects on hyperlipidemia by reducing cholesterol levels and inhibiting lipid synthesis. Other compounds in garlic, such as diallyl disulfide, diallyl trisulfide, and S-allyl cysteine, also contribute to its potential lipid-lowering properties by influencing lipid metabolism and reducing cholesterol synthesis in the liver. However, while studies suggest these constituents may have beneficial effects on lipid levels, more research is needed to fully understand their mechanisms and effectiveness in managing hyperlipidemia.

Applications and Efficiency

- People with endometriosis, a severe uterine ailment, appear to experience less pain after taking garlic powder tablets orally every day for three months. arterial hardening, or atherosclerosis. Garlic powder taken orally, either by alone or in combination with other components, appears to help reduce artery hardening.
- Diabetes: In both individuals with and without diabetes, using garlic powder orally appears to slightly lower blood sugar levels before meals. It appears to be most effective when used for a minimum of three months. Garlic may or may not lower HbA1c or post-meal blood sugar levels.
- High blood cholesterol or other fats (lipids): People with high blood cholesterol may see a reduction in total cholesterol and low-density lipoprotein (often known as "bad") cholesterol if they take garlic orally every day for at least eight weeks. However, any advantage is most likely minimal. Furthermore, eating garlic had little effect on lowering blood fat levels known as triglycerides or raising high-density lipoprotein.
- High blood pressure: In individuals with high blood pressure, taking garlic orally appears to lower diastolic blood pressure by roughly 4-6 mmHg and systolic blood pressure (the top number) by roughly 7-9 mmHg.
- A severe gum infection (periodontitis): People with mild to moderate periodontitis may benefit from taking aged garlic extract orally twice a day for 18 months.

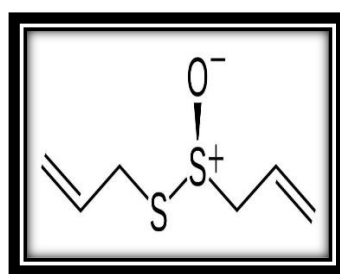


Fig 07- Chemical structure of Allicin



Fig 08- Garlic

Side Effects-

1. Garlic is probably safe for most people to consume orally. For up to seven years, garlic has been used safely. It may result in adverse consequences like diarrhea, gas, heartburn, and foul breath. Raw garlic frequently exacerbates these negative effects. Additionally, garlic may induce allergic reactions.
2. Garlic products may be safe to apply topically. Garlic-based mouthwashes, gels, and pastes have been on the market for three months. However, garlic can result in burn-like skin injury. Applying raw garlic topically could be dangerous. It could really irritate your skin.

Dosage -Adults have typically consumed 2400 mg of garlic orally every day for a duration of 12 months.

Conclusion

Hyperlipidemia is a condition characterised through increased degrees of lipids within the blood, which can grow the threat of cardiovascular sicknesses. treatment is regularly endorsed for human beings with hyperlipidemia due to the related risks. Terminalia arjuna, cinnamon, and garlic are herbs that have been studied for his or her ability blessings in managing coronary heart associated conditions, including angina, heart disease, and excessive blood strain, however, greater research is wanted to completely aid these makes use of. the principle point of the given text is that garlic is typically utilized in Arjuna, Cinnamon, Garlic doses of 120,80,60 mg respectively every day for one year, and it's far essential to look for coated dietary supplements to make sure they dissolve inside the intestine. additionally, the textual content gives statistics at the technique of coaching and evaluation checks for tablets

REFERENCE

1. Saxena, P., & Sarwat, M. (2024). Ayurveda and lifestyle diseases. In *Ethnic Knowledge and Perspectives of Medicinal Plants* (pp. 373-388). Apple Academic Press.
2. Selvi, P. T. A Review on Anti-Hyperlipidemic Properties of Some Important Medicinal Plants.
3. Gyawali, D., Vohra, R., Orme-Johnson, D., Ramaratnam, S., & Schneider, R. H. (2021). A systematic review and meta-analysis of ayurvedic herbal preparations for hypercholesterolemia. *Medicina*, 57(6), 546.
4. Mishra, A., Vijayaraghavalu, S., & Kumar, M. (2022). Cardiovascular disorders and herbal medicines in India. In *Herbal Medicines* (pp. 525-555). Academic Press.
5. Gyawali, D. (2017). *Systematic Reviews and Meta-Analyses on Effects of Ayurvedic Interventions for Hypercholesterolemia, Hypertension, and Coronary Heart Disease*. Maharishi University of Management.
6. Saxena, P., & Sarwat, M. (2023). Ayurveda and lifestyle diseases. In *Ethnic Knowledge and Perspectives of Medicinal Plants* (pp. 373-388). Apple Academic Press.
7. Gyawali, D. (2017). *Systematic Reviews and Meta-Analyses on Effects of Ayurvedic Interventions for Hypercholesterolemia, Hypertension, and Coronary Heart Disease*. Maharishi University of Management.
8. M Zarshenas, M., Zargarani, A., & Blaschke, M. (2017). Convenient, traditional and alternative therapies for cardiovascular disorders. *Current Pharmaceutical Design*, 23(7), 1112-1118.
10. Mehrotra, N. N., Ojha, S. K., & Tandon, S. (2007). Drug development for cardiovascular diseases from ayurvedic plants. *Feature*, 1, 89.
11. Bankar, J. S., Bondre, K. N., Wagh, P. P., Bhoje, S. S., Pande, J. S., Itankar, P. R., ... & Gurav, S. S. (2024). Herbal Medicines for the Management of Diseases in the Heart, Circulation, and Blood. In *Role of Herbal Medicines: Management of Lifestyle Diseases* (pp. 129-144). Singapore: Springer Nature Singapore.
12. Phadke, A. S. (2007). A review on lipid lowering activities of Ayurvedic and other herbs.
13. Akhiani, S. P., Gotmare, S. R., & Akhiani, S. P. A Comparative Study of Brahmi Leaves (Bacopa Monnieri) Powder and Arjuna Bark (Terminalia Arjuna) Powder of Medicinal Importance in Ayurveda on Serum Cholesterol In-Vitro.
14. Nandu, B. S., Shete, M. N. A., & Deshmukh, V. K. REVIEW ON IMPORTANCE OF AYURVEDA IN HUMAN LIFE.
15. Pandit, S., Biswas, T. K., Bera, S., Saha, S., Jana, U., & Sur, T. K. (2024). Efficacy of Heart Revival, an Ayurvedic formulation, in hypertension and related risks—An exploratory single arm open label trial. *Journal of Ayurveda and Integrative Medicine*, 15(4), 100975.