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A Novel Polyherbal Formulation for Hyperlipidemia: Development, Characterization and Phrmacological Assessment

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Abstract: *Hyperlipidemia is a major risk factor for cardiovasculardisease, and there is increasing interest in plant-based therapies for its management. This research investigates the development and evaluation of a polyherbal syrup formulated using Allium sativum (garlic), Trigonellafoenum-graecum (fenugreek), Curcuma longa (turmeric), and Cinnamomumverum(cinnamon), each known for their lipid-lowering, antioxidant, and anti-inflammatory effects. The polyherbal formulation was prepared as an aqueous syrup and subjected to preliminary phytochemical screening, which confirmed the presence of key bioactive compounds including allicin, diosgenin, curcuminoids, and cinnamaldehyde. In vivo studies on hyperlipidemic animal models demonstrated significant reductions in total cholesterol, LDL-C, and triglyceride levels, along with a moderate increase in HDL-C. The results suggest a synergistic hypolipidemic action of the combined herbs, potentially mediated through modulation of lipid metabolism and antioxidant mechanisms. This polyherbal syrup presents a promising alternative or adjunct to conventional lipid-lowering therapies.*

Based on your previous work on a cholesterol-lowering polyherbal syrup formulated with garlic, fenugreek, turmeric, and cinnamon, here's a clear purpose statement you

The purpose of this polyherbal syrup formulation is to develop a natural, plant-based therapeutic agent aimed at lowering elevated cholesterol levels (hyperlipidemia).

Objective:

• Reduce total cholesterol, LDL cholesterol, and triglycerides
• Improve HDL cholesterol levels
• Support cardiovascular health through anti-atherosclerotic and hepatoprotective effects
• Offer a safer, cost-effective, and complementary alternative to conventional lipid-lowering medications..

Keywords: Hyperlipidemia, pathophysiology, medications, diagnosis , polyherbal syrup

I. INTRODUCTION

Hyperlipidemia is a condition where there are abnormally high levels of lipids (fats) in the blood. These lipids include cholesterol and triglycerides. It is a major risk factor for cardiovascular diseases, including heart attack and stroke.

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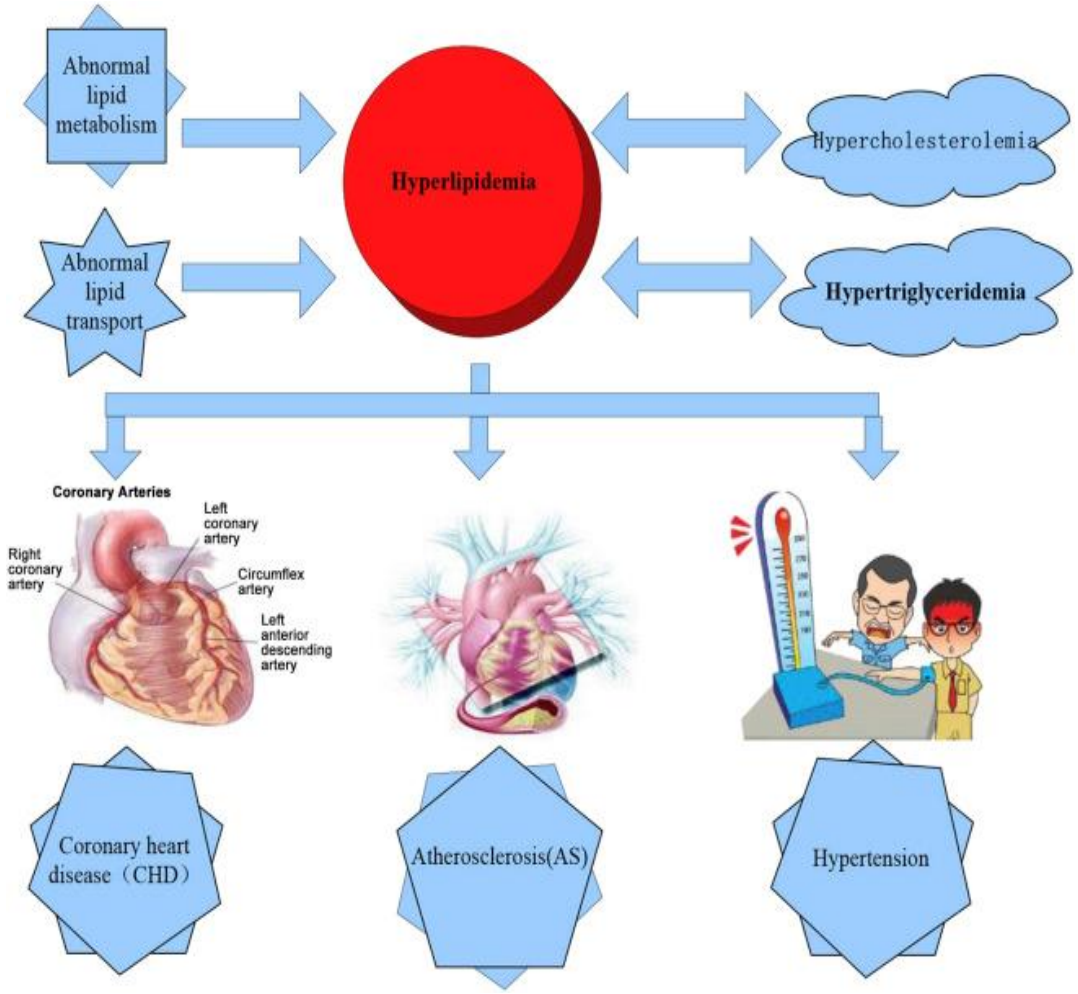

Types of Lipids Involved:

Low-Density Lipoprotein (LDL) – "Bad" Cholesterol
High-Density Lipoprotein (HDL) – "Good" Cholesterol
Triglycerides
Total Cholesterol

Types of Hyperlipidemia:

Primary (Genetic):
Caused by inherited genetic disorders (e.g., familial hypercholesterolemia).
Secondary:
Result of other conditions like diabetes, obesity, hypothyroidism, kidney disease, or poor diet/lifestyle.

Causes:

- Unhealthy diet (high in saturated fat, trans fat)
- Lack of physical activity
- Obesity
- Smoking
- Alcohol overuse
- Medical conditions (like diabetes or liver disease)
- Genetics

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Symptoms:
Usually no symptoms until complications develop (e.g., chest pain, stroke).
In severe cases: xanthomas (fatty deposits under the skin), xanthelasma (around eyes)

Diagnosis:
Medical History – Assess for family history, cardiovascular risk factors, and lifestyle habits.
Physical Examination – Look for signs like xanthomas and measure BMI and blood pressure.
Lipid Profile Test – Key blood test measuring:
Total Cholesterol
LDL-C ("bad" cholesterol)
HDL-C ("good" cholesterol)
Diagnostic Criteria –
Abnormal values:
Total Cholesterol > 200 mg/dL
LDL-C > 130 mg/dL
HDL-C < 40 mg/dL (men), < 50 mg/dL (women)
Triglycerides > 150 mg/dL
Repeat Testing – Confirm with at least two separate tests if needed.

Allopathic medicines:
1. Statins – Atorvastatin, Rosuvastatin (lower LDL)
2. Ezetimibe – (blocks cholesterol absorption)
3. PCSK9 Inhibitors – Alirocumab, Evolocumab (strong LDL lowering)
4. Fibrates – Fenofibrate, Gemfibrozil (lower triglycerides)
5. Niacin – (raises HDL, lowers triglycerides)
6. Omega-3 Fatty Acids – Vascepa, Lovaza (lower triglycerides)
7. Bile Acid Sequestrants – Cholestyramine (lower LDL)
8. Bempedoic Acid – (alternative LDL-lowering agent)

Pathophysiology:
Hyperlipidemia, in particular elevated LDL (hypercholesterolemia), is one of the most prevalent risk factors contributing to the evolution of atherosclerosis and consequent vascular disease. It is simply defined as elevated concentrations of lipids or fats within the blood. Numerous factors contribute to the development of atherosclerosis, including endothelial damage, hyperlipidemia, inflammatory and immunologic factors, plaque erosion or rupture, hypertension, and smoking. Atherosclerosis frequently remains asymptomatic until plaque stenosis reaches 70 to 80% of the vessel's diameter. Atherosclerosis originates after underlying endothelial damage occurs, which appears to stem from the loss of nitric oxide within the endothelium. This process leads to increased inflammation directly around the site of dysfunction, permitting the accumulation of lipids within the innermost layer of the endothelial wall. The lipids are then engulfed by macrophages, leading to the establishment of "foam cells." This cholesterol build-up within the "foam cells" causes subsequent mitochondrial dysfunction, apoptosis, and, ultimately, necrosis of the underlying tissues. Smooth muscle cells encapsulate the pack of "foam cells" or debris, which produces a fibrotic plaque that inhibits the underlying lipids (debris) from being destroyed[1]
Tissue factor, alongside increased platelet activity, is known as a primary initiator of coagulation, which increases the risk for plaque rupture and thrombosis. Atherosclerotic plaques evolve via two distinct mechanisms: a slower, chronic plaque build-up that progressively leads to luminal stenosis, versus an acute onset of rapid luminal obstruction secondary to plaque rupture and thrombosis[3] Both mechanisms are capable of causing clinically significant disease that should be addressed by a physician as soon as possible.

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For most patients, hyperlipidemia is polygenic in inheritance, and the manifestation of the disorder is considerably influenced by factors such as (central) obesity, saturated fat intake, and the cholesterol content within a person's diet. Another mechanism involves elevated levels of "apo B-100" lipoproteins within the plasma, which may lead to atherosclerotic disease, even when the patient has no other risk factors. It is often that there is a combination of genetic and environmental factors at play that ultimately contribute to a person's risk of developing hyperlipidemia and cardiovascular disease.

Many systemic diseases, which stimulate an inflammatory sub-layer with clinical or sub-clinical values, can cause dyslipidemia and atherosclerotic problems. Some examples:

- Psoriasis
- Crohn disease
- Inflammatory bowel disease
- Chronic obstructive pulmonary disease
- Depression
- Chronic pain

Ayurvedicherbal remedies for hyperlipidemia :

1. **Garlic**:

1. Biological Source:

Botanical Name: Allium sativum

Family: Liliaceae

Part Used: Bulb (commonly known as garlic)

2. Mechanism of Action (MOA):

Allicin

Reduces cholesterol production in the liver by inhibiting HMG-CoA reductase.

Lowers total and LDL (bad) cholesterol.

Ajoene

Prevents blood clots and improves blood flow.

Helps lower lipid levels.

S-allyl cysteine (SAC)

Found in aged garlic extract; supports cholesterol reduction.

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Has antioxidant and liver-protective effects.
Diallyl disulfide (DADS)
Reduces cholesterol and triglycerides.
Protects against oxidative stressed
Alliin
Precursor to allicin; supports cholesterol-lowering effects

3. Uses:
Cardiovascular Health:
Reduces cholesterol and triglyceride levels
Lowers blood pressure
Prevents atherosclerosis
Antimicrobial: Effective against bacteria, fungi, and viruses
Antioxidant and Anti-inflammatory
Anticancer potential: Especially against gastrointestinal cancers

2. Turmeric:
1. Biological Source:
Botanical Name: Curcuma longa
Family: Zingiberaceae
Part Used: Rhizome
2. Mechanism of Action (MOA) :

Inhibition of cholesterol synthesis:
Cur cumin down regulates HMG-CoA reductase, the key enzyme in cholesterol biosynthesis (same target as statins).
Increased LDL receptor expression:
Helps the liver uptake and clear LDL ("bad cholesterol") from the bloodstream.
Enhances bile acid excretion:
Promotes cholesterol conversion to bile salts, increasing excretion.
Antioxidant effect:
Prevents oxidation of LDL, reducing risk of atherosclerosis.

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3. Uses :
Lowers total cholesterol
Reduces LDL (bad cholesterol)
Raises HDL (good cholesterol)
Protects against atherosclerosis and plaque formation

3. Cinnamon:
1. Biological Source:
Common Name: Dalchini / Cinnamon
Botanical Name: Cinnamomumverum (also Cinnamomumzeylanicum)
Family: Lauraceae
Part Used: Dried inner bark
2. Mechanism of Action :
Cinnamaldehyde
Inhibits HMG-CoA reductase, reducing cholesterol synthesis.
Enhances LDL receptor expression, increasing LDL clearance.
Polyphenols (e.g., Proanthocyanidins)
Act as antioxidants to prevent LDL oxidation and reduce lipid peroxidation.
Eugenol
Provides anti-inflammatory and antioxidant effects, protecting blood vessels.
Cinnamic acid

Improves insulin sensitivity, indirectly lowering lipid levels.
Fiber and tannins
Promote bile acid excretion, aiding cholesterol removals

3. Uses:
Reduces LDL (“bad cholesterol”)
May increase HDL (“good cholesterol”)
Reduces triglyceride levels
Prevents atherosclerosis by reducing oxidative stress and inflammation
Supports metabolic health, including blood sugar and insulin sensitivity

4. Fenugreek:
Biological Source:

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Common Name: Fenugreek
Botanical Name: Trigonellafoenum-graecum
Family: Fabaceae
Part Used: Seeds (mainly), also leaves

2. Mechanism of Action (MOA):

1. Reduces cholesterol absorption in the intestines through its high fiber content
2. Increases bile acid excretion, making the liver use more cholesterol to replace lost bile.
3. Lowers total and LDL (bad) cholesterol levels.
4. Improves HDL (good) cholesterol slightly.
5. Contains saponins that bind to cholesterol and help remove it from the body.

3. Uses :

Lowers total cholesterol
Reduces LDL and triglycerides
May increase HDL
Reduces fat absorption and improves fat metabolism

Formula:

Ingredients	Batch A	Batch B	Purpose
Garlic extract	4 ml	5 ml	Reduces LDL, Total cholesterol
Fenugreek extract	4 ml	5 ml	High fiber , lipid Regulation
Turmeric extract	2ml	3 ml	Anti-inflammatory , liver support
Cinnamon extract	1 ml	2 ml	Improve good cholesterol
Sorbitol	10 ml	20ml	Sweetener, humectant
Glycerin	5 ml	10 ml	Sweetener, preservation
Citric acid	0.1g	0.2 g	PH control

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Sodium benzoate	0.005 g	0.1g	Preservation
Natural flavour	q. s	q. s	Taste masking
Purified water	q. s 100 ml	q. s 100 ml	Solvent

Method of preparation forpolyherbal remedies :

1. Method of preparation Decoction:

Garlic Extraction :

Procedure:

Add crushed garlic to solvent (1:5 ratio).

Gently warm using the mantle at below 40°C for 30 minutes.

Avoid boiling to preserve allicin.

Cool, filter, and store.

Fenugreek Extraction:

Procedure:

Mix powder with solvent (1:10 ratio).

Heat at 60–70°C for 1–2 hours with occasional stirring.

Allow to cool, then filter and store.

Turmeric Extraction:

Procedure:

Add powder and solvent to round-bottom flask (1:10 ratio).

Heat on mantle at 60–70°C for 2 hours.

Stir or use magnetic stirrer if available.

Cool, filter, and concentrate the extract.

Cinnamon Extraction:

Procedure:

Add cinnamon to solvent (1:10 ratio).

Heat at 60–70°C for 1–2 hours.

Allow to cool, filter, and store in a dark bottle

2. Method of preparationpolyhedral syrup:

Dissolve 0.1 g sodium benzoate and 0.2 g citric acid in 10 mL of warm purified water.

Add 20 mL sorbitol solution and 10 mL glycerin, mix thoroughly.

Add herbal extracts: garlic, fenugreek, turmeric, and cinnamon one by one, with stirring.

Add flavoring agent as required.

Make up the final volume to 100 mL with purified water.

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Mix well and transfer into sterilized amber glass or PET bottles.
Storage & Dosage:
Storage: Cool, dry place below 25°C; protect from light.
Dosage: 10 mL twice daily after meals or as directed by a physician

Evaluation:

Physical Evaluation:
Color examination :
Five ml final syrup was taken into watch Glass and placed against white back ground in White tube light. It was observed for its colour by
Naked eye.
Odourexamination :
Two ml of final syrup was smelled Individually. The time interval among two smelling Was kept 2 minutes to nullify the effect of previous Smelling.
Test examination :
A pinch of final syrup was taken and Examined for its taste on taste buds of the tongue. Or simply a pinch of syrup was put on tip off
Tongue for determining test.
Determination of pH :
• Placed an accurately measured amount 10 ml
Of the final syrup in a 100 ml volumetric flask And made up the volume up to 100 ml with Distilled water. The solution was sonicated for About 10 minutes. pH was measured with the Help of digital pH meter.

Result:

Color: Brownish yellowcolour
Odor: Pleasant herbal aroma, with a hint of added flavor (eg orange).
Taste: Slightly sweet with mild herbal bitterness, well-masked by flavoring agents.
pH: Should be in the range of 4.0 to 5.0 suitable for syrup stability and palatability.
Clarity: Should be clear or slightly translucent; free from visible particles.

II. CONCLUSION

The polyherbal syrup made with garlic, fenugreek, turmeric, and cinnamon is a natural and effective way to help lower cholesterol levels. Each of these herbs has special health benefits that work together to reduce bad cholesterol, support the liver, and improve overall heart health. The syrup is easy to take, has a pleasant taste, and is safe for regular use. With added ingredients like sorbitol and sodium benzoate, the syrup stays fresh and stable for a long time. This herbal syrup could be a good, natural option for people who want to manage their cholesterol without using chemical medicine.

REFERENCES

[1]. Banerjee, S. K., &Maulik, S. K. (2002). Effect of garlic on cardiovascular disorders: a review. Nutrition Journal, 1(1), 4.
[2]. Amagase, H., Petesch, B. L., Matsuura, H., Kasuga, S., &Itakura, Y. (2001). Intake of garlic and its bioactive components. The Journal of Nutrition, 131(3), 955S–962S.
[3]. Basch, E., Ulbricht, C., Kuo, G., Szapary, P., & Smith, M. (2003). Therapeutic applications of fenugreek. Alternative Medicine Review, 8(1), 20–27.
[4]. Madar, Z., & Stark, A. H. (2002). New legume sources as therapeutic agents. British Journal of Nutrition, 88(S3), S287–S292.
[5]. Aggarwal, B. B., &Harikumar, K. B. (2009). Potential therapeutic effects of curcumin, the anti-inflammatory agent, against neurodegenerative, cardiovascular, pulmonary, metabolic, autoimmune and neoplastic diseases. International Journal of Biochemistry & Cell Biology, 41(1), 40–59.

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[6]. Panahi, Y., et al. (2016). Curcuminoids modify lipid profile in type 2 diabetes mellitus: A randomized controlled trial. Complementary Therapies in Medicine, 27, 1–5.

[7]. Ranasinghe, P., et al. (2012). Medicinal properties of 'true' cinnamon (Cinnamomumzeylanicum): a systematic review. BMC Complementary and Alternative Medicine, 13, 275.

[8]. Anderson, R. A., Broadhurst, C. L., et al. (2004). Cinnamon improves glucose and lipids of people with type 2 diabetes. Diabetes Care, 27(12), 3215–3218.

[9]. Patel, S. S., et al. (2011). Polyherbal formulation: Concept of ayurveda. Pharmacognosy Reviews, 5(9), 1–6.

[10]. Tripathi, Y. B., & Sharma, M. (1998). Hypolipidemic activity of Momordicacharantia and Trigonellafoenum-graecum in atherogenic diet fed rabbits. Indian Journal of Physiology and Pharmacology, 42(3), 373–378.

[11]. Aggarwal, B. B., &Harikumar, K. B. (2009). Potential therapeutic effects of curcumin, the anti-inflammatory agent, against neurodegenerative, cardiovascular, pulmonary, metabolic, autoimmune and neoplastic diseases. International Journal of Biochemistry & Cell Biology, 41(1), 40–59.

[12]. Amaras, H., Petesch, B. L., Matsuura, H., Kasuga, S., &Itakura, Y. (2001). Intake of garlic and its bioactive components. The Journal of Nutrition, 131(3), 955S–962S.

[13]. Anderson, R. A., Broadhurst, C. L., Polansky, M. M., Schmidt, W. F., Khan, A., Flanagan, V. P., … & Graves, D. J. (2004). Cinnamon improves glucose and lipids of people with type 2 diabetes. Diabetes Care, 27(12), 3215–3218.

[14]. Banerjee, S. K., &Maulik, S. K. (2002). Effect of garlic on cardiovascular disorders: a review. Nutrition Journal, 1(1), 4.

[15]. Basch, E., Ulbricht, C., Kuo, G., Szapary, P., & Smith, M. (2003). Therapeutic applications of fenugreek. Alternative Medicine Review, 8(1), 20–27.

[16]. Madar, Z., & Stark, A. H. (2002). New legume sources as therapeutic agents. British Journal of Nutrition, 88(S3), S287–S292.

[17]. Panahi, Y., Khalili, N., Sahebi, E., Namazi, S., Reiner, Ž., &Majeed, M. (2016). Curcuminoids modify lipid profile in type 2 diabetes mellitus: A randomized controlled trial. Complementary Therapies in Medicine, 27, 1–5.

[18]. Ranasinghe, P., Pigera, S., Premakumara, G. A. S., Galappaththy, P., Constantine, G. R., &Katulanda, P. (2013). Medicinal properties of 'true' cinnamon (Cinnamomumzeylanicum): a systematic review. BMC Complementary and Alternative Medicine, 13, 275.

[19]. Tripathi, Y. B., & Sharma, M. (1998). Hypolipidemic activity of Momordicacharantia and Trigonellafoenum-graecum in atherogenic diet fed rabbits. Indian Journal of Physiology and Pharmacology, 42(3), 373–378.

[20]. Patel, S. S., Shah, R. S., &Goyal, R. K. (2011). Polyherbal formulation: Concept of ayurveda. Pharmacognosy Reviews, 5(9), 1–6