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Review Article

Potential Pharmacological Effect Of Fenugreek On Hyperlipidemia

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ABSTRACT

Trigonella foenum-graecum, the herb known as fenugreek, has drawn interest for its possible advantages in treating hyperlipidemia, a disorder marked by high blood lipid levels that increases the risk of cardiovascular illnesses. Research suggests that using fenugreek supplements can raise levels of high-density lipoprotein (HDL) and dramatically lower levels of triglycerides, low-density lipoprotein (LDL), and total cholesterol. These effects are caused by mechanisms that include altered metabolic pathways, increased lipid excretion, and suppression of intestinal cholesterol absorption. Furthermore, fenugreek's antioxidant qualities might help guard against the oxidative stress caused by hyperlipidemia. All things considered, fenugreek appears to have potential as a natural supplementary treatment for hyperlipidemia; nevertheless, larger-scale clinical trials are necessary to determine consistent dosing and long-term safety.

INTRODUCTION

Hyperlipidemia, which is brought on by dietary problems, obesity, genetic diseases like familial hypercholesterolemia (FH), or other illnesses like diabetes, is defined as excessively raised levels of lipids or lipoproteins in the blood due to improper fat metabolism or function. Cardiovascular disease (CVD) is roughly twice as likely to occur in those with hyperlipidemia. Several studies have shown that, in addition to its well-known role in promoting atherosclerosis in the blood vessels, hyperlipidemia may also directly affect the heart. These effects may include increased ischemia/reperfusion injury and a decreased

response to cardiac protective interventions such as ischemic preconditioning and postconditioning. Long-term hyperlipidemia impairs cardiac function and electrophysiological activity even when there is no obvious coronary artery stenosis by causing cardiac lipids to build up. Despite a wealth of research on the causes and consequences of hyperlipidemia, little is understood about how the condition directly affects the heart and the underlying mechanisms [Yao et al., 2020]. Abnormal blood levels of lipids and lipoproteins are associated with dyslipidaemia. Triglycerides (TG), low-density lipoprotein cholesterol (LDL-

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C), total cholesterol (TC), and lowered high-density lipoprotein cholesterol (HDL-C) are the symptoms. The prevalence of dyslipidemia as a major risk factor and its prognostic significance in reducing the incidence of stroke and myocardial infarction (MI) have drawn more attention recently due to its widespread use as an independent predictor of many cardiovascular and cerebrovascular events worldwide [Wright Jet al., 2024]. The most frequent type of chronic heart disease (CHD), myocardial infarction accounts for nearly 15% of annual deaths and is more common in men than in women of all ages. About 7.4 million fatalities in 2015 were attributed to CHD, and by 2030, the disease is predicted to claim the lives of 23.6 million individuals. The prevalence of MI varies with age, with men under 45 having a 0.06% prevalence and men over 75 having a 2.46% prevalence [Samara R et al., 2021]. Lower levels of triacylglycerols (TG), low-density lipoprotein cholesterol (LDL-C), and plasma total cholesterol (TC) are some of the risk factors for cardiovascular disease (CVD), one of the leading causes of death in modern industrialized cultures. Furthermore, transfusion gibes are essential for managing public health. Estimates indicate that a drop in LDL-C of 10 mmol/L is associated with a 22% reduction in the risk of CVD mortality and morbidity, while TG values more than 10 mmol/L are associated with a significantly increased risk of acute pancreatitis and CVD. The use of high-density lipoprotein cholesterol (HDL-C) has been

found to be inversely linked to the risk of CVD in addition to these other factors. Estimates indicate that a drop in LDL-C of 10 mmol/L is associated with a 22% reduction in the risk of CVD mortality and morbidity, while TG values more than 10 mmol/L are associated with a significantly increased risk of acute pancreatitis and CVD. Along with these other factors, it has also been discovered that high plasma levels of HDL-C (high-density lipoprotein cholesterol) are inversely linked to the risk of CVD; however, the application of state-of-the-art medications that target HDL-C to reduce the burden of CVD has not shown the anticipated beneficial effect [Nie et al.,2021]. In the family Fabaceae, fenugreek (*Trigonella foenum-graecum* Linn) is a legume. The chemicals found in fenugreek seeds number close to 175. Active ingredients found in fenugreek include fibers, phenolic acid compounds, steroid saponin chemicals, flavonoids, hydrocarbons, alkaloids, terpenes, fatty acids, glycosides, carbohydrates, and amino acids, as well as their derivatives [Khatoon N et al., 2024]. The triangular flowers are the source of the genus *Trigonella*, which means "little triangle" in Latin. One of the most promising traditional plants, it is widely grown as an indigenous medicine, spice, and herbal food in many countries of Africa, Europe, and Asia. For medicinal uses, fenugreek seeds and leaves are prepared as an extract and powder [Albaker et al.,2023].

Table 1: Fenugreek World Wide identification

Preferred scientific name	<i>Trigonella foenum-graecum</i> L
Preferred common name	Fenugreek
International common names	
English	Common fenugreek, goat's horn, Greek hayseed
French	Fenugrec, sénégré
Spanish	Fenugreco
Hindi	Methi
Portuguese	Fenacho, fenogregq
Local common names	
Germany	Bockshornklee, griechischerschabzigerklee
Indonesia	Kelabet, klabet



Italy	Fieno Greco
Malaysia	Halba, kelabat, venthiam
Myanmar	Penantazi, venthiam
Maldives	Venthiam
Netherlands	Fenegriek
Sweden	Bockhornskloever
EPPO code	TRKFG (Trigonella foenum-graecum)

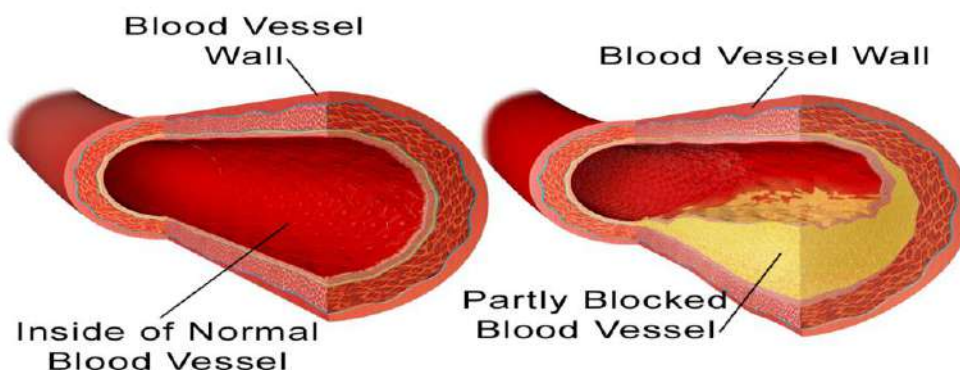


Fig :1 (A) Normal blood vessel

Fig: 1 (B) Hyperlipidemic blood vessel

Symptoms of Hyperlipidemia

Typically, Hyperlipidemia does not exhibit any overt symptoms; instead, symptoms are usually detected via routine testing or when the condition becomes close to the point where a heart attack or stroke could occur. Patients who have familial versions of the condition or high blood cholesterol

may develop xanthomas, or cholesterol deposits under the skin, particularly around the eyes. Patients with high triglyceride levels may experience many pimple-like lesions at various body regions at the same time [Yuan Y et al.,2021].



Fig: 2 Symptoms of Hyperlipidemia

Complications of hyperlipidemia

Atherosclerosis

The primary risk factor for atherosclerosis, the primary cause of cardiovascular disease, is hyperlipidemia. The pathologic process known as atherosclerosis is typified by the build-up of lipids, cholesterol, and calcium in the walls of large and

medium-sized arteries, as well as the formation of fibrous [Jethra G et al., 2020].

Heart Valve Disease (CAD)

Atherosclerosis, a condition marked by cholesterol accumulation and the formation of fibrous plaques inside the arterial walls, is the main cause of coronary artery disease (CAD). The heart is left

with inadequate oxygen to meet its needs as a result of the arteries supplying blood to the myocardium constricting. Heart atherosclerosis development has been linked to elevated lipid profiles [Hedayatnia M et al.,2020].

Infraction of the Heart (MI)

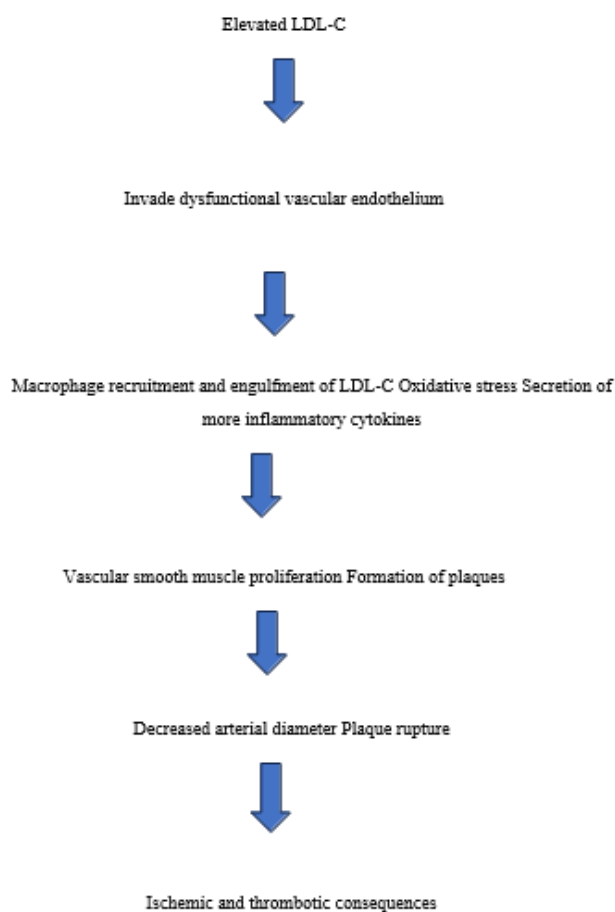
MI is a disorder that develops when one or more cardiac arteries are totally or partially blocked from receiving blood and oxygen, which damages or kills heart cells. Atherosclerotic plaque rupture could be the cause of the blockage. According to the studies, approximately 25% of myocardial

Pathophysiology

infarction survivors had elevated cholesterol levels.

Ischemic stroke

The fourth most typical source of mortality is stroke. Typically, a blood clot or a fragment of atherosclerotic plaque that breaks loose in a tiny blood vessel inside the brain blocks an artery, resulting in a stroke. Several clinical research have shown that a 15% reduction in low-density lipoprotein and total cholesterol significantly lowers the risk of experiencing a first stroke [Shattat et al.,2015].



Treatment of hyperlipidemia

1. Life style changing

The goal of the initial course of treatment for hyperlipidemia is to try to improve the patient's lifestyle before starting medication. In certain situations, taking these actions now will be critical in avoiding the need for hypolipidemic medications

and spare patients from adverse consequences. These adjustments include: controlling weight for individuals who are overweight or obese; reducing the amount of cholesterol and fats in daily meals; reducing alcohol use; and giving up smoking. Regular exercise can take the form of walking or light sports. Conversely, however including some



healthy foods, such as cold-water fish, in the daily diet can help lower the level of triglycerides due to their Omega-3 content. Similarly, soybean and soy

nut contain antioxidant agents that can lower the level of bad cholesterol [Aguilar-Salinas CA et al.,2022].

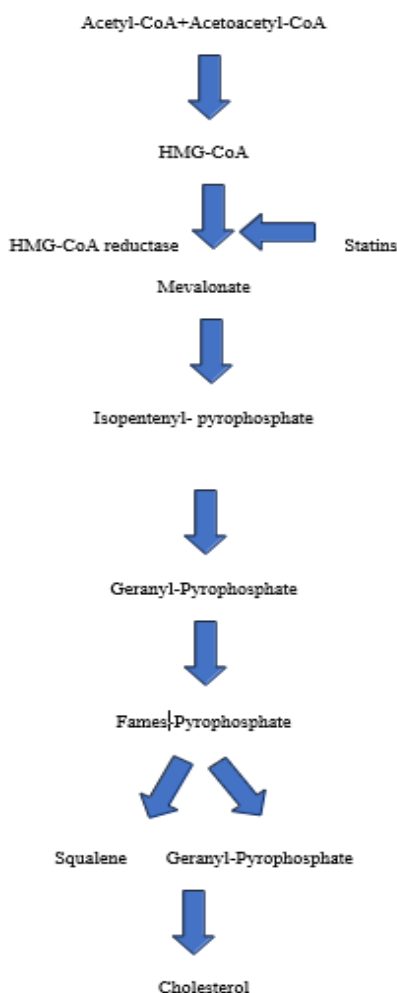


Fig: 3 Modifications in Lifestyle to lower cholesterol

2. Hyperlipidemia Treatment in Pharmacology

Lipid lowering agents are used when changing life style (first line) is failed to reduce blood lipid levels.

Mechanism of action of Statins



The Dietary Benefits of Fenugreek

Enhancing the health and performance of biological systems requires the diverse array of nutrients and bioactive compounds included in fenugreek. 58% carbohydrates, 0.9% fats, 25% fiber, and 23-26% proteins are found in fenugreek seeds. In the same way, fenugreek leaves have 6%, 4.4%, 1.1%, and 6% of carbohydrates, proteins, and fiber, within them. Magnesium (42 mg/100 g), zinc (2.4 mg/100 g), potassium (603 mg/100 g), iron (25.8 mg/100 g), manganese and copper (0.9 mg/100 g), and calcium (75 mg/100 g) are among the minerals found in fenugreek. Furthermore considered to be important components of fenugreek are beta carotene (19 mg/100 g) and vitamin C (220 mg/100 g) [Gupta RC et al., 2021]. Fenugreek also contains large amounts of several important amino acids, such as aspartic acid, glutamic acid, leucine, tyrosine, and phenylalanine. Additionally, it has trace levels of amino acids that include sulphur, such cysteine and methionine, which are crucial to the body's physiological processes. The most common free amino acid in fenugreek is (2S, 3 R, 4 S)-4-hydroxyisoleusine. About 80% of the amino acid content in dried fenugreek seeds is composed of the non-protein amino acid 4-hydroxyisoleusine, which grows rapidly throughout the growth phase. Studies have indicated that the quality of the proteins in fenugreek is superior than other plant-based proteins. After comparing the two types of proteins in a research, Feyzi and his colleagues found that fenugreek seeds contain higher protein levels and a better amino acid profile than soy protein isolate. Fenugreek proteins also had high levels of aspartic and glutamic acids. Additionally, fenugreek proteins were shown to be more stable, soluble, foamy, and to have a higher denaturation temperature than soy proteins. They can be included as a helpful source of protein in a range of useful meals because of these factors. Moreover, fenugreek includes sotalone, an

important functional phytochemical used as a taste ingredient [Singh U et al.,2022]. Fenugreek contains notable concentrations of alkaloids, including trigonella, trigocoumarin, nicotinic acid, and trimethyl coumarin. Flavonoids and polyphenols are among the other important and advantageous ingredients it contains. Fenugreek plant alcoholic extracts contain a wide variety of flavonoids, such as quercetin, luteolin, vitexin, and 7, 4-dimethoxy flavanones. A few additional groups have also reported similar results regarding the presence of tricetin, quercetin, kaempferol, aglycones, and naringenin. The compounds were isolated from certain fenugreek plant sections, as well as from hydrolysates and extracts of the stems, leaves, and flowers [Dhull SB et al., 2021]. According to the phytochemical analysis of fenugreek, the majority of flavonoids are found as glycosides, which are complex compounds resulting from the conjugation of carbohydrates by O- and C-glycosidic bonds. Rare examples of flavonol glycosides found in fenugreek include quercetin-3-O-rhamnoside (quercitrin), vitexin-7-O-glucoside (afroside), and apigenin-6-C-glucoside (isovitexin). Fenugreek seeds sequestered apigenin-6-C-glucoside, which is vitexin, and apigenin-8-C-glucoside, which is vitexin. It has also been stated that this herb contains aglycones, or isoflavonoid phytoalexins, like medicarpin and maackiain. These are referred to as "induced isoflavonoids," and they can be created by microbial activity or other external sources [Syed QA et al., 2020].





Fig: 4 Fenugreek

Presentation of Clinical Data

Hypercholesterolemia, although seldom presenting with overt symptoms, is a major cardiovascular disease risk factor. Overweight cholesterol can lead to corneal arcus and xanthomas; this condition is usually connected to familial hypercholesterolemia. Complications from uncontrolled hypercholesterolemia include peripheral vascular disease, stroke, hypertension, carotid artery disease, and type 2 diabetes (T2DM) [Mansoori Aet al.,2020] Systemic diseases associated with influencing dyslipidemia include psoriasis, Crohn's disease, inflammatory bowel disease, chronic obstructive lung disease, depression, chronic pain, and chronic kidney disease. A 2017 observational study involving 7,641 Europeans over 50 revealed that 1,591 (20.8%) of the subjects had high triglyceride or low HDL values. In addition, these individuals had a higher risk of obesity, type 2 diabetes mellitus, and alcohol use beyond the recommended weekly limit. Fifty-five percent of the patients were not on any lipid therapy and had elevated TG and low HDL. Hypercholesterolemia-related problems can be managed with appropriate lipid management. Additional guidelines have been established to address the appropriate administration of lipid-lowering drugs to help lower cholesterol after the publication of the 2018 lipid guidelines. This study aims to present an overview of the ACC/AHA 2018 guidelines and examine newly developed

drugs that have come into the market since the guidelines were released [Mittal et al., 2021].

Fenugreek as potential therapeutic agent against several diseases

Antioxidant Activity

Since free radicals are a source of reactive oxygen species (ROS) that can disrupt lipid membrane structure and trigger a cascade of events that can lead to a range of diseases, researchers have been researching them for a long time. It has been found that natural products are a safe and effective way to reduce the generation of free radicals. Among the plant extracts with demonstrated antioxidant qualities is fenugreek. Several investigations have been carried out by researchers to determine the antioxidant potential of fenugreek. Free radicals can be neutralized by the methanolic seed extract of fenugreek seeds, according to research done on rat liver to evaluate the seeds' antioxidant potential. The components that are believed to be involved are flavonoids and phenolic compounds because of their self-polar character, which is frequently indicative of their existence in polar solvent systems. Because of its ability to squelch radicals, fenugreek extracts can therefore be a suitable option to minimize the bad impacts of a number of disorders and can be used for treatment [Wang Het al., 2024].

Hypocholesterolemic Activity

Scientists from all around the world have studied fenugreek extracts' capacity to reduce cholesterol in great detail. Several in vivo experiments have been carried out on a variety of rabbit species in addition to rats and mice. An analysis of the effects of fenugreek leaves on cholesterol levels was carried out. Albino rabbits with dried fenugreek leaf consumption had higher HDL cholesterol and decreased levels of triglycerides, LDL, VLDL, and total blood cholesterol. The presence of cholesterol in plasma is indicative of coronary heart disease. Researchers have looked into how fenugreek seed extract affects the plasma lipid

profile. When fenugreek seed and its extracts were administered, the levels of plasma cholesterol, triglycerides, and LDL cholesterol were significantly decreased. Galactomannan, diosgenin, and fiber are the particular saponins that are the chemical components in charge of the activity [Murad Set al., 2024].

Gastro protective Effect

Researchers have tried extracting not just other forms of extracts but also oil, which has pharmacological benefits, from fenugreek seeds. Among these is fenugreek seed oil's gastroprotective properties. It was observed that the incidence of gastrointestinal ulceration, mean ulcer score, and ulcer index were significantly reduced in a group of mice that were given indomethacin to induce ulcers. The decrease in stomach ulcers can be attributed to the presence of phytotic acid, saponins, and trigonelline in fenugreek essential oil. Fenugreek seed aqueous extract has been shown in one study to prevent reflux esophagitis (RE) in rats, which suggests that it could be used in clinical trial research [Pandey et al., 2017].

Anti-diabetic effect

Currently, there are a lot of synthetic commercial medications on the market for treating problems of the metabolism of carbohydrates, such as diabetes; however, these medications can be costly and frequently cause unwanted side effects. Therefore, it's critical to look into natural options for the treatment of metabolic diseases like diabetes. Studies have been done on the possible advantages of fenugreek seeds for the treatment of diabetes. Fenugreek seeds' high soluble fiber content reduces blood glucose levels by slowing down the digestion and absorption of carbs. Fenugreek seed powder was given as a supplement to diabetic patients for three months. The study found that the patients' postprandial and fasting blood sugar levels fell, suggesting that fenugreek may be a useful natural blood glucose-regulating

supplement. A different study that looked at the effects of fenugreek seed powder solution on diabetic patients discovered that it reduced dyslipidemia by raising levels of high-density lipoproteins and decreasing levels of triglycerides, total cholesterol, and low-density lipoproteins. Twenty patients with borderline diabetes who drank fenugreek juice for a month saw a significant drop in their PPBS levels when tests were performed before and after the month. Research also revealed that fructosamine and PPBS levels were lowered by consuming fenugreek seeds that had been defatted, germinated, and powdered [Haxhiraj et al., 2024].

Anti-cancer effect

Many therapeutic plants and herbs include active ingredients that can be protective during cancer therapy. Specifically, research by AlTimimi has shown that at a concentration of 400 µg/ml, fenugreek seed extract inhibits the proliferation of almost half of the human breast cancer MCF-7 cell line without necrosis or apoptosis. Diosgenin, a steroidal saponin with an estrogen-like structure that is present in fenugreek seeds, has been demonstrated by numerous researchers to possess proapoptotic and anticancer properties in both vitro and in vivo settings. It has been discovered that fenugreek seed oil reduces the viability of malignant cells, and that fenugreek ethanolic extract inhibits cell viability and tube formation while promoting cell cytotoxicity in chick chorio allantoic membrane. Furthermore, it has been discovered that methanolic fenugreek seed extract reduces MCF-7 cancer cells' ability to proliferate and metastasize. Still unknown is fenugreek's precise anticancer mechanism, which will require more study to pinpoint its precise mode of action [Tewari et al., 2024].

Tolerability and Safety:

When used moderately, fenugreek is generally thought to be safe for most people. On the other hand, it might cause stomach problems in certain



people and interfere with medication. It's best to speak with a doctor before beginning fenugreek supplementation.

In Conclusion:

While fenugreek may be a helpful supplement in the management of hyperlipidemia, traditional treatments should still be used in addition to it. Along with other pharmacological therapies and lifestyle changes, its significance in lipid management should be taken into account. To completely grasp its advantages and find the best way to employ it in lipid control, more research is required.

REFERENCES:

1. Alloubani A, Nimer R, Samara R. Relationship between hyperlipidemia, cardiovascular disease and stroke: a systematic review. *Current Cardiology Reviews*. 2021 Dec 12;17(6).
2. Aguilar-Salinas CA, Gómez-Díaz RA, Corral P. New therapies for primary hyperlipidemia. *The Journal of Clinical Endocrinology & Metabolism*. 2022 May 1;107(5):1216-24.
3. Dhull SB, Chandak A, Bamal P, Malik A, Kidwai MK. Fenugreek (*Trigonella foenum-graecum*): Nutritional, health properties and food uses. *Fenugreek: Biology and Applications*. 2021:219-46.
4. Gupta RC, Doss RB, Garg RC, Srivastava A, Lall R, Sinha A. Fenugreek: Multiple health benefits. In *Nutraceuticals* 2021 Jan 1 2021 (pp. 585-602). Academic Press.
5. Haxhiraj M, White K, Terry C. The role of fenugreek in the management of type 2 diabetes. *International journal of molecular sciences*. 2024 Jun 26;25(13):6987.
6. Hedayatnia M, Asadi Z, Zare-Feyzabadi R, Yaghooti-Khorasani M, Ghazizadeh H, Ghaffarian-Zirak R, Nosrati-Tirkani A, Mohammadi-Bajgiran M, Rohban M, Sadabadi F, Rahimi HR. Dyslipidemia and cardiovascular disease risk among the MASHAD study population. *Lipids in health and disease*. 2020 Dec;19:1-1.
7. Jethra G, Choudhary S, Sharma V. Identification and characterization of microsatellite markers in fenugreek: an inter-family amplification. *Legume Research-An International Journal*. 2020;43(5):611-6.
8. Khatoon N, Savita KK, Chaudhary JS, Chanchal DK, Son M. Fenugreek Use: Biological Role of Fenugreek in Health of Human Being-A Review:. *Journal of Advanced Zoology*. 2024 Apr 1;45(2).
9. Mansoori A, Hosseini S, Zilae M, Hormoznejad R, Fathi M. Effect of fenugreek extract supplement on testosterone levels in male: A meta-analysis of clinical trials. *Phytotherapy Research*. 2020 Jul;34(7):1550-5.
10. Murad S, Hassni MA, Tanveer ZH, Majeed F, Fatima A, Firdous A, Samreen S, Musawwir UA. Fenugreek Leaves and Lemon are Mild to Moderately Effective Hypolipidemic Herbs to Lower Total Plasma Cholesterol, Triglycerides, and LDL Cholesterol in Primary and Secondary Hyperlipidemic Patients. 2024.
11. Naser IH, Alkareem ZA, Mosa AU. Hyperlipidemia: pathophysiology, causes, complications, and treatment. A review. *Karbala Journal of Pharmaceutical Sciences*. 2021 Jan 1;1(19).
12. Nie Y, Luo F. Dietary fiber: An opportunity for a global control of hyperlipidemia. *Oxidative Medicine and Cellular Longevity*. 2021;2021(1):5542342.
13. Pandey Meenakshi, Singh D.C, Kumar Naveen, Kandpal Asheesh. Therapeutic Significance of Fenugreek W.S.R To Its Hypolipidemic Activity. *International Journal of Ayurveda and Pharma Research*. 2017;5(7):58-62.

14. Singh U, Chamoli M, Singh KP, Ram L, Jangir S, Maheshwari RK. Amazing health benefit of fenugreek (*Trigonella foenum-graecum* Linn.). *International Journal of Environment and Health Sciences*. 2022;4:19-27.
15. Song M, Li J, Wu B, Wang H, Yi Y, Xu W, Guo D. Effect of fenugreek seed extract as a natural oxidation inhibitor on quality of marinated duck drumsticks during storage. *LWT*. 2024 May 1;199:116011.
16. Shattat GF. A review article on hyperlipidemia: types, treatments and new drug targets. *Biomedical and pharmacology journal*. 2015 May 3;7(1):399-409.
17. Syed QA, Rashid Z, Ahmad MH, Shukat R, Ishaq A, Muhammad N, Rahman HU. Nutritional and therapeutic properties of fenugreek (*Trigonella foenum-graecum*): a review. *International Journal of Food Properties*. 2020 Jan 1;23(1):1777-91.
18. Tewari A, Singh R, Brar JK. Pharmacological and Therapeutic Properties of Fenugreek (*Trigonella foenum-graecum*) Seed: A Review. *Journal of Phytopharmacology*. 2024;13(2):97-104.
19. Wright J, Subramanian S. Therapy for Hyperlipidemia. *Medical Clinics*. 2024 Sep 1;108(5):881-94.
20. Yao YS, Li TD, Zeng ZH. Mechanisms underlying direct actions of hyperlipidemia on myocardium: an updated review. *Lipids in Health and Disease*. 2020 Dec;19:1-6.
21. Yuan Y, Chen W, Luo L, Xu C. Dyslipidemia: Causes, symptoms and treatment. *International Journal of Trend in Scientific Research and Development*. 2021 Feb;5(2):1013-6.

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