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EVALUATING THE CHOLESTEROL-LOWERING EFFICACY OF NIGELLA SATIVA EXTRACT IN ARAT MODEL OF DIET-INDUCED HYPERCHOLESTEROLEMIA

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ABSTRACT
This study investigated the cholesterol-lowering effects of Nigella sativa seed extract in a rat model of diet-induced hypercholesterolemia and atherosclerosis. The experiment utilized a Soxhlet extraction method with methanol-water (70:30 v/v) to obtain the extract, followed by phytochemical analysis. Rats were divided into five groups: a control group on a regular diet, a high-cholesterol diet group without treatment, and three treatment groups on a high- cholesterol diet receiving either Atorvastatin (10mg/kg) or Nigella sativa extract at 250mg/kg and 500mg/kg doses. Over 21 days, the control group showed a minor increase in cholesterol levels from 59.04 mg/dl to 63.94 mg/dl. In contrast, the high-cholesterol diet group significantly rise from 129.8 mg/dl to 171 mg/dl. Atorvastatin treatment resulted in a moderated increase from 51.22 mg/dl to 91.06 mg/dl. Groups treated with Nigella sativa extractshowed intermediate increases (250mg/kg: 102.6 mg/dl to 130 mg/dl; 500mg/kg: 88.6 mg/dl to 117.8 mg/dl). The efficacy of Nigella sativa was calculated as 33.50% for the 250mg/kg dose and 29.13% for the 500mg/kg dose, compared to the untreated high cholesterol group. These results were slightly lower than those of Atorvastatin, which showed an efficacy of 31.22% for the 250mg/kg dose and 26.71% for the 500mg/kg dose. The study demonstrates that while Nigella sativa seed extract has a moderate cholesterol-lowering effect, its efficacy exhibits a potential plateau beyond a specific dosage and is less effective than Atorvastatin.

KEYWORDS: Nigella sativa, Hypercholesterolemia treatment, Antihyperlipidemic effect, Rat model cholesterol, Antihyperlipidemic effect, Herbal medicinecardiovascular.

INTRODUCTION
Medicinal plants have a vital role in global healthcare, as 80% of the world's population depends on them for both sustenance and medicinal purposes (Huang, Liu & Shao, 2009; WHO). India, abundant in biological variety, provides a wide range of these plants. Due to their bioactive compounds, they play a crucial role in the development of innovative, safe, and cost-effective medications, especially for treating disorders in human cells (Mandal et al., 2008; Seo et al., 2009; Khan et al., 2009). These plants possess a wide range of phytochemicals and nutraceuticals, which have a role in many biological processes and therapies, such as cancer, due to their phenolic compounds and flavonoids that are recognized for their antioxidantcapabilities (Venkidesh et al., 2010; Reddy et al., 2010).

ATHEROSCLEROSIS
Hyperlipidemia, characterized by elevated levels of low-density lipoprotein cholesterol (LDL- C) and reduced levels of high-density lipoprotein cholesterol (HDL-C), plays a crucial role in the progression of atherosclerosis and associated conditions such as coronary heart disease (CHD), ischemic cerebrovascular diseases, and peripheral vascular disease. These problems mostly impact individuals in their middle-aged and senior years and are a major contributor to illness and death. As a result of increasing rates of obesity and a growing elderly population, itis anticipated that the occurrence of these illnesses would rise.

Atherosclerosis is a multifaceted inflammatory condition characterized by the buildup of lipids in the walls of major and intermediate-sized arteries, resulting in the formation of lesions. The clinical symptoms involve the sudden blockage of blood vessels caused by the production of blood clots, leading to conditions such as heart attacks, strokes, and peripheral artery disease.

Plaque rupture, which is then followed by reperfusion, can produce free radicals that cause further harm to organs and have the potential to result in death.

Atherosclerosis manifests in numerous forms, impacting different arteries such as the coronary arteries (producing coronary artery disease), carotid arteries (resulting in carotid artery disease), and peripheral arteries (leading to peripheral artery disease). This condition is defined by the accumulation of plaque in the arteries, consisting of fat, cholesterol, and calcium, which solidifies and narrows the blood vessels, leading to a decrease in blood flow and a lack of oxygenated blood supply to organs and tissues.

Major contributors to the development of atherosclerosis are elevated levels of cholesterol, consumption of fatty foods, the natural process of aging, and hereditary predisposition. Common risk factors encompass a familial predisposition to the ailment, a lack of physical activity, an unhealthy dietary pattern, elevated blood pressure, tobacco consumption, and diabetes. These several elements collectively lead to the deterioration of arteries and the development of plaque, hence elevating the likelihood of heart and other vascular disorders.

METHODOLOGY

Plant material

The seeds of Nigella sativa were purchased from a local market (Guntur) and their identification was confirmed in the laboratory.

Extraction Methodology

5 g of powdered seed was used in a soxlet apparatus and boiled in respective solvents of methanol: Water (70:30 v/v) for 30 min and extracted for 3 hours. After extraction the solvents were removed by rotary vacuum evaporator (40ºC) and dried in a vacuum oven at 30ºC for2 hours. phytochemical investigation was performed.

Chemicals

1. Cholesterol
2. Cholic acid
3. Propylthio-uracil
4. Peanut oil
5. Lard oil
6. Atorvastatin

Equipments

1. Rotary vacuum evaporator
2. Vacuum oven
3. Auto analyzer

Material Animals

Albino Wister rats of either sex (170-200g) were produced from SIMS college animal house, Guntur. Animals were housed in poly propylene cage. The laboratory conditions were maintained as follows, room temperature (25±2 0C) with 12 h light/dark cycle. The animals were provided with pellet chow and water and libitum. Ethical clearance was obtained from Institutional Animal Ethical Committee (IAEC) of SIMS college of Pharmacy (1523/PO/Bt/S/12/CPCSEA).

METHODS

Cholesterol diet induced atherosclerosis in rats

Excessive cholesterol feeding leads to susceptibility to hypercholesterolemia and atherosclerosis. Therefore this approach has been chosen to study the effect of anti atherosclerotic drugs.

Procedure

In rats hypercholesterolemia was induced by daily administration by the gavage of 1ml/100g body weight of cocktail containing in 700ml of peanut oil and 300ml lard oil, 100g cholesterol, 30g propylthio-uracil, and 100g of cholic acid over a period of 21 days. The test compound was administered two times a day. Before 24 hr of sacrificing the animals were kept for fasting and had free access to water. Blood was collected by retro orbital route for biochemical estimation. Then rats were sacrificed and aorta, coronary artery and lungs were collected and were kept in 15%v/v formalin solution for histopathological examination.

Animals are divided into 5 groups of 6 rats in each group:

Group 1: animals received normal diet

Group 2: animals received high cholesterol diet

Group 3: animals received high cholesterol diet followed by the administration of Atorvastatin(10mg/kg b.w) by oral administration.

Group 4: animals received high cholesterol diet followed by the administration of extract of Nigella sativa seeds (250mg/kg b.w) by oral administration.

Group 5: animals received high cholesterol diet followed by the administration of extract of Nigella sativa seeds (500mg/kg b.w) by oral administration.

The anti-atherosclerotic activity was accessed by following parameter

A) Biochemical parameters

B) Histopathological studies

RESULTS

Cholesterol diet-induced hypercholesterolemia in rats Total cholesterol

Table no 1: Effect of hydro alcoholic Extract of seeds of Nigella sativa on total cholesterol in cholesterol-diet induced hypercholesterolemia.

Group	Mean±SEM Total cholesterol	
	10th Day	21st Day
Control	59.04±2.92	63.94± 3.65
CD	129.8±2.42****[a]	171.0± 1.50****[a]
CD+ATOR (10mg/kg)	51.22±2.12****[b]	91.06± 1.97****[b]
CD+NS (250mg/kg)	102.6±2.96****[b]	130.0± 1.38****[b]
CD+NS (500mg/kg)	88.6±3.01****[b]	117.8± 3.05****[b]

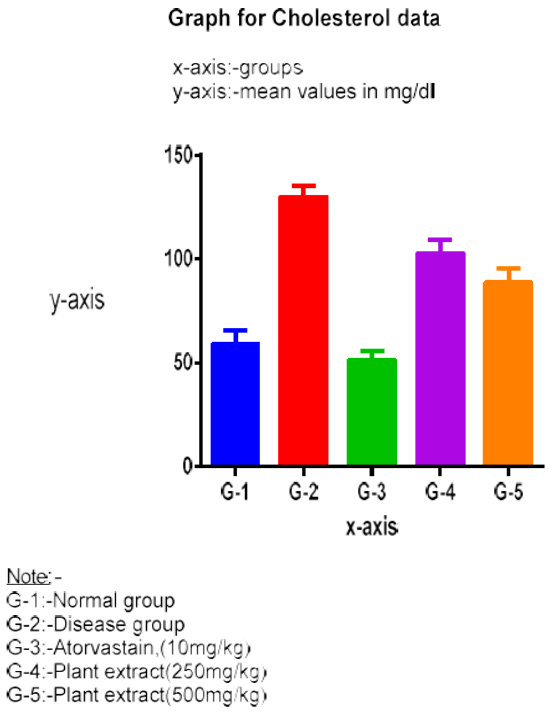

Fig. no. 1: Cholesterol at 10th day: Effect of hydro alcoholic extract of seeds of Nigella sativa on total cholesterol in cholesterol diet induced hyperlipidemia.

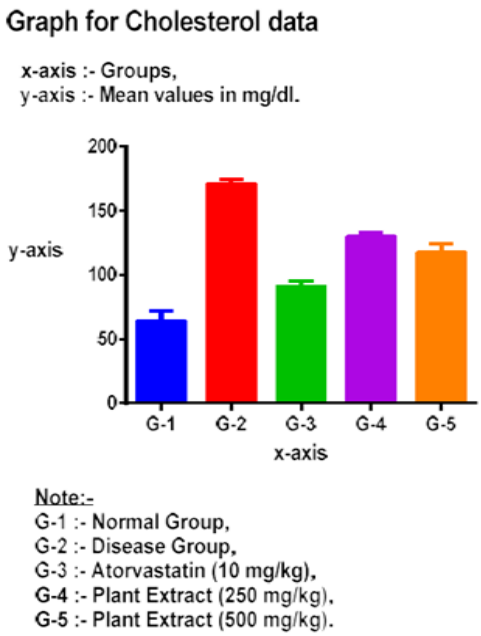

Fig. no. 2: Cholesterol at 21th day: Effect of hydro alcoholic extract of seeds of Nigella sativa on total cholesterol in cholesterol diet induced hyperlipidemia.

DISCUSSION

The study's examination of the cholesterol-reducing properties of Nigella sativa seed extract offers useful information for prospective therapies targeting hypercholesterolemia. The research strategy is extensive and strong since it utilizes Soxhlet extraction for the extract and compares its efficacy with Atorvastatin, a conventional medicine. The findings suggest that Nigella sativa has a modest impact in reducing cholesterol levels, albeit it is somewhat less potent than Atorvastatin. This discovery is noteworthy as it indicates the possibility of utilizing a natural chemical in conjunction with or as a substitute for traditional pharmacological interventions in order to regulate cholesterol levels.

An important finding from the study is that the effectiveness of Nigella sativa levels off after reaching a particular dose. This suggests that increasing dosages do not have a proportionate impact on the therapeutic efficacy, which might have an impact on its clinical use. Although Nigella sativa has lesser efficacy than Atorvastatin, the study suggests that it might be used as a supplementary treatment rather than a substitute. This highlights the importance of conducting more research.

In summary, this research enhances our comprehension of the involvement of Nigella sativa in cardiovascular well-being. Subsequent investigations should prioritize the examination of the enduring consequences, potential drug interactions, and effectiveness in human participants. This research has the potential to expand the use of natural products in medical treatment, namely in the management of hypercholesterolemia and atherosclerosis.

CONCLUSION

The experimental tests demonstrate that the hydroalcoholic extract of Nigella sativa seeds, administered at two distinct dosages of 250mg/kg and 500mg/kg, has anti-atherosclerotic action and provides cardiovascular protection. The potential antiatherosclerotic and cardioprotective effects of Nigella sativa may be attributed to its phytochemical components, including Nigellone, Nigellimine-N-oxide, Nigellidine, carvone, thymoqinone, and thymole. Therefore, more research on individual chemical components is necessary to identify a possible drug with antiobesity and antiatherosclerotic properties. In summary, the hydroalcoholic extract of Nigella sativa has both antiobesity and antiatherosclerotic properties.

REFERENCES

1. Ahmad, A., Husain, A., Mujeeb, M., Khan, S. A., Najmi, A. K., Siddique, N. A., Damanhouri, Z. A., & Anwar, F. A review on therapeutic potential of Nigella sativa: A miracle herb. *Asian Pacific Journal of Tropical Biomedicine*, 2013; 3(5): 337-352.
2. Al-Naqeep, G., Al-Zubairi, A. S., Ismail, M., Amom, Z. H., & Esa, N. M. (2009). Antiatherogenic potential of Nigella sativa seeds and oil in diet-induced hypercholesterolemia in rabbits. *Evidence-Based Complementary and Alternative Medicine*, 2011.

3. Al-Naqeeb, G., Ismail, M., & Al-Zubairi, A. S. Fatty acid profile, tocopherolcontent and total antioxidant activity of oil extracted from Nigella sativa seeds. *International Journal of Pharmacology*, 2010; 6(4): 245-250.
4. Alkharfy, K. M., Ahmad, A., Khan, R. M., & Al-Shagha, W. M. Pharmacological properties of Nigella sativa hydro-alcoholic extract and its impact on oxidative stress in animal models of diabetes. *International Journal of Pharmacology*, 2015; 11(7): 705-712.
5. Amin, B., & Hosseinzadeh, H. Black cumin (Nigella sativa) and its active constituent, thymoquinone: An overview on the analgesic and anti-inflammatory effects. *Planta Medica*, 2016; 82(1-2): 8-16.
6. Asgary, S., Sahebkar, A., Afshani, M. R., Keshvari, M., Haghjooyjavanmard, S., & Rafieian-Kopaei, M. Clinical investigation of Nigella sativa in human volunteers with hyperlipidemia. *Pharmacognosy Research*, 2013; 5(4): 275.
7. Dehkordi, F. R., & Kamkhah, A. F. Antihypertensive effect of Nigella sativa seed extract in patients with mild hypertension. *Fundamental & Clinical Pharmacology*, 2008; 22(4): 447-452.
8. Gilani, A. H., Jabeen, Q., Khan, M. A., & Shah, A. J. Gut modulatory, blood pressure lowering, diuretic and sedative activities of cardamom. *Journal of Ethnopharmacology*, 2008; 115(3): 463-472.
9. Haas, M. J., & Mooradian, A. D. Regulation of high-density lipoprotein metabolismby Nigella sativa and its constituent thymoquinone. *Journal of Diabetes & MetabolicDisorders*, 2011; 10: 16.
10. Kocyigit, Y., Atamer, Y., & Uysal, E. The effect of dietary supplementation of Nigella sativa L. on serum lipid profile in rats. *Saudi Medical Journal*, 2009; 30(7): 893-896.
11. Mohamad, N. A., Kamaruddin, M. Y., & Rahman, N. A. Nigella sativa and its protective role in oxidative stress and hypertension. *Evidence-Based Complementary and Alternative Medicine*, 2011.
12. Salem, M. L. Immunomodulatory and therapeutic properties of the Nigella sativa L. seed. *International Immunopharmacology*, 2005; 5(13-14): 1749-1770.
13. Zaoui, A., Cherrah, Y., Mahassine, N., Alaoui, K., Amarouch, H., & Hassar, M. Effects of Nigella sativa fixed oil on blood homeostasis in rat. *Journal of Ethnopharmacology*, 2002; 79(1): 23-26.
14. Devaraj, S., Singh, U., & Jialal, I. The role of dietary supplementation with plant sterols and stanols in the prevention of cardiovascular disease. *Nutrition Reviews*, 2006; 64(7): 348-354.
15. Sheweita, S. A., & Sheikh, B. Y. Can dietary antioxidants reduce the incidence of brain disorders? *Journal of Nutritional Biochemistry*, 2011; 22(1): 1-7.