

Hypolipidemic activity of *Sesbania grandiflora* in triton wr-1339 induced hyperlipidemic rats

A. Saravanakumar¹, S. Vanitha², M. Ganesh¹, J. Jayaprakash³, N.M. Ramaswamy¹

*Corresponding author:

A. Saravanakumar

¹ Pharmaceutical Sciences
Discipline, Bio-technology
Centre, Anna University,
Coimbatore-641047,
Tamilnadu, India.

² Department of
Pharmaceutical Analysis, The
Erode College of Pharmacy,
Veppampalayam Pirivu,
Erode-638112, Tamilnadu,
India.

³ Anti Rabies Division,
Pasteur Institute of India,
Coonor, The Nilgiris-
643103, Tamilnadu, India.
Tel.: +91-98948-85858

E-mail:

saravncp@gmail.com

Abstract

Hyperlipidemia is the greatest risk factor of coronary heart disease. Currently available hypolipidemic drugs have been associated with number of side effects. Herbal treatment for hyperlipidemia has no side effects and is relatively cheap and locally available. A literature claims that flavonoids can able to reduce the hyperlipidemia. Based on high flavonoid content in herbal, *Sesbania grandiflora* (SG) was selected and the present study focus on the anti-hyperlipidemic activity of aqueous extract of leaves of SG against triton induced hyperlipidemia in rats. SG administered a dose of 200 μ g/kg (p.o) to the triton induced hyperlipidemic rats. SG shows a significant decrease in the levels of serum cholesterol, phospholipid, triglyceride, LDL, VLDL and significant increase in the level of serum HDL at the dose of 200 μ g/kg (p.o) against Triton induced hyperlipidemic in rats. Aqueous extract of leaves of SG was investigated hypolipidemic activity on Triton induced hyperlipidemic profile. Aqueous extract fraction decreased serum level of total cholesterol by 69.72. On the other hand, aqueous extract of SG increased the serum HDL cholesterol level by 24.11. The reduction of LDL cholesterol level by aqueous extract was 30.31.

Keywords: *Sesbania grandiflora*- Hyperlipidemia- LDL- VLDL- HDL

Introduction

Hyperlipidemia has been ranked as one of the greatest risk factors contributing to prevalence and severity of coronary heart diseases [1]. Coronary heart disease, stroke, atherosclerosis and hyperlipidemia are the primary cause of death [2]. Hyperlipidemia characterized by elevated serum total cholesterol and low density and very low density lipoprotein cholesterol and decrease high density lipoprotein are the risk factor for coronary heart diseases. Hyperlipidemia associated lipid disorders are considered to cause the atherosclerotic

cardiovascular disease [3]. Among these hypercholesterolemia and hyper triglyceridemia are closely related to ischemic heart disease [4]. The main aim of treatment in patients with hyperlipidemia is to reduce the risk of developing ischemic heart disease or the occurrence of further cardiovascular or cerebrovascular disease [5]. Currently available hypolipidemic drugs have been associated with number of side effects [6]. The consumption of synthetic drugs leads to hyperuricemia, diarrhoea, nausea, myositis, gastric irritation, flushing, dry skin and abnormal

liver function [7]. Medicinal plants are used for various research purposes. It has been reported that traditional systems have immune potential against various diseases. More than thirteen thousand plants have been studied for various pharmacological properties. An herbal treatment for hypercholesterolemia has no side effects and is relatively cheap, locally available. They are effective in reducing the lipid levels in the system [8]. Hyperlipidemia was classified into primary and a secondary type clearly indicates the complexities associated with disease. The primary disease may be treated baker's yeast anti-lipidemic drugs but the secondary type originating from diabetes, renal lipid nephrosis or hypothyroidism demands the treatment of original disease rather than hyperlipidemia [9]. Consumption of much fat may lead to the production of extra VLDL, resulting in the formation of large amounts of LDL which may stick to the walls of the blood vessels if the quantity of HDL is insufficient, causing blockages for the normal flow of blood. Therefore, it is improvement in human diet is highly recommended for disease prevention [10]. The medicinal plants were plays a major role in hypolipidemic activity. The leaves of *Aleurites moluccana*, *Piper betle* suggests that the lipid lowering action is mediated through inhibition of hepatic cholesterol biosynthesis and reduction of lipid absorption in the intestine [11]. Based on the above, *Sesbania grandiflora* (Fabaceae) was selected which is native to many Asian countries like India, Malaysia, Indonesia and Philippines from sea level to 800m. *Sesbania grandiflora* L. (Fabaceae) is popularly known as "Basna" is an ornamental plant and is found in plains of western Himalayas to Sri Lanka [12]. *Sesbania grandiflora* is a folk remedy for bruises, catarrh, dysentery, eyes, fevers, headaches, small pox, sores, sore throat and stomatitis [13]. It is a small erect quick growing short-lived, soft-wooded tree to 10m tall, sparsely branched. Bole straight and cylindrical, the wood white and soft. Bark light grey, corky, deeply furrowed. Leaves pinnate, 15-30cm long, with 16-30 pairs of linear oblong leaflets. Racemes 2.5cm long. Flowers 2-4, white

to pink, pendulous the corolla 7-9cm long, pods 50-60cm long. Bark, leaves, gums and flowers are considered medicinal. The astringent bark was used in treating small pox and other eruptive fevers. The juice from the flowers is used to treat headache, head congestion of stuffy nose. Rheumatic swellings are poulticed or rubbed with aqueous decoctions of the powdered roots of the red flowered variant. Ayurvedics, believing the fruits to be alexeteric, laxative and intellectually stimulating, prescribe them for anaemia, bronchitis, fever, pain, thirst, ozoena and Quartan fever. Yuani consider the tonic levels useful in biliousness, fever and nyctalopia. Indians apply the roots in rheumatism, the juice of the leaves and flowers for headache and nasal catarrh [14]. In Amboina, flower juice is squeezed in to the eye to correct dim vision. The bark is used in infusions for small pox. Cambodians consider the flowers emollient and laxative, the bark for diarrhea, dysentery and paludism.

Malayans apply crushed leaves to sprains and confusions. They gargle with the leaf juice to cleanse the mouth and throat. In small doses, the bark is used for dysentery and sprue, in large doses, laxative, in still larger doses, emetic. Pounded bark is applied to scabies. Philippines use the pounded bark for hemottysis. The powdered bark is also recommended for ulcers of the mouth and alimentary canal. In java, the bark is used for thrush and infantile disorders of the stomach. Leaves are chewed to disinfect the mouth and throat [15].

Materials and Methods

Chemicals

Triton WR-1335 (a non-ionic detergent, iso octyl polyoxy ethylene phenol, form aldehyde polymer) was obtained from chemico scientific chemicals, Erode. All other chemicals were of analytical grade and obtained locally.

Plant material

The dried leaves of *Sesbania grandiflora* (SG) were collected from Erode district, Tamil Nadu, India in the month of June – July 2009. The plant

Table 1. Effect of aqueous extract of SG on HDL, LDL and VLDL in serum of control and experimental rats

Parameters	HDL	LDL	VLDL
Group-I control	23.22±2.31	24.67 ± 1.78	14.66 ± 2.51
Group-II Triton treated	17.70 ± 6.10 ^a	154.52 ± 8.51 ^a	23.1 ± 2.01 ^a
Group-III	24.10 ± 3.11 ^b	30.33 ± 3.51 ^b	15.32 ± 2.11 ^b
Triton + SG (200 mg kg ⁻¹)			
Group-IV	24.30 ± 3.10 ^b	25.71 ± 3.34 ^b	14.4 ± 2.10 ^b
Triton + Fenofibrate			

Values are in mean ± SD; Number of animals in each group = 5; ^a p < 0.001 Vs Group I; ^b p < 0.001 Vs Group II

leaves was identified by Botanical survey of India, Coimbatore, Tamilnadu.

Preparation of Plant Extract

Weighed quantities of coarsely powdered leaves of SG were placed in maceration flask and add with sufficient quantity of purified water. The complete maceration was takes place for about 24

hrs, during time the first 6 hours with occasional shaking and the remaining hours was set a side. After 24 hours maceration process the menstrum was collected and evaporated to get solvent off to obtain as dried extract. This extract was mixed with 5% CMC and which was used to various experimental purposes [16].

Table 2. Effect of aqueous extract of SG on cholesterol, triglycerides, phospholipids in serum of control and experimental rats

Parameters	Cholesterol	Triglyceride	Phospholipids
Group-I control	62.57 ± 5.52	73.30 ± 5.57	156.25 ± 9.32
Group-II Triton treated	195.22 ± 10.58 ^a	115.1 ± 5.57 ^a	207.27 ± 10.81 ^a
Group-III	69.70 ± 5.53 ^b	76.53 ± 5.96 ^b	177.70 ± 6.23 ^b
Triton + SG (200 mg kg ⁻¹)			
Group-IV	65.43 ± 2.51 ^b	72.0 ± 11.01 ^b	159.54 ± 7.53 ^b
Triton + Fenofibrate			

Values are in mean ± SD; Number of animals in each group = 5; ^a p < 0.001 Vs Group I; ^b p < 0.001 Vs Group II

Animals

Wistar albino adult male rats weighing 200-250gm from center for animal health, Nandha College of pharmacy, Erode-52, were housed in polypropylene cages in room where the congenial temperature $27^{\circ}\text{C} \pm 1^{\circ}\text{C}$ and 12 hrs light and dark

cycles were maintained. The animals were allowed to acclimatize to the environment for 7 days and supplied with a standard pellet diet were collected from Hindustan Lever Ltd, Bangalore.

Table 3. Effect of aqueous extract of SG on Cholesterol, Triglycerides, Phospholipids in Liver of Control and Experimental Rats

Parameters	Cholesterol	Triglyceride	Phospholipids
Group-I control	64.81 \pm 1.73	61.23 \pm 0.67	85.42 \pm 0.51
Group-II Triton treated	265.0 \pm 3.55 ^a	112.5 \pm 0.86 ^a	143.2 \pm 0.93 ^a
Group-III Triton + SG (200 mg kg ⁻¹)	99 \pm 1.31 ^b	90.3 \pm 1.07 ^b	90.5 \pm 1.60 ^b
Group-IV Triton + Fenofibrate	89.52 \pm 2.33 ^b	81.5 \pm 1.89 ^b	75.24 \pm 2.55 ^b

Values are in mean \pm SD; Number of animals in each group = 5; ^a p < 0.001 Vs Group I; b p < 0.001 Vs Group II

Pharmacological Evaluation

The animals were divided into three groups of five rats each. First were given standard pellet diet water and orally administered with 5% CMC. Second group were given a single dose of triton was administered 400 mg/kg. After 72 hours of triton injection received a daily dose of 5% CMC (p.o) for 7 days. According to LD₅₀ value third group was administered a daily dose of SG aqueous extract 200mg/kg suspended in 5% CMC (p.o) for 7 days, after inducing hyperlipidemia.

Collection of blood

On the 8th day the blood was collected by retro orbital sinus puncture, under mild ether anaesthesia. The collected samples were centrifuged for 10 minutes. Then serum samples were collected and it is used for various biochemical experiments. Then animals were sacrificed and collected the liver [17].

Liver lipid extraction

The liver was homogenized in cold 0.15M KCl and extracted with CHCl₃: CH₃OH (2% v/v). This lipid extract was used for the estimation of lipid parameters [18].

Biochemical analysis

The serum and liver were assayed total cholesterol, triglycerides, phospholipids, high-density lipoprotein (HDL), low-density lipoprotein (LDL), very low-density lipoprotein (VLDL). The serum cholesterol levels were determined Zak's method. The triglycerides, phospholipids, serum HDL, LDL and VLDL was calculated by using standard methods.

Result

Hyperlipidemia is associated with the heart diseases, which is the leading cause of death in the world. The low levels of such harmful lipids to satisfactory values have been confirmed baker's yeast several experimental animal and

interventional studies indicating lowered morbidity and mortality in coronary heart diseases.

The results were discussed under the following headings.

1) Lipid profile in serum

2) Lipid profile in liver

Lipid profile in serum and liver indicates the increased phospholipids; triglyceride and cholesterol levels were significantly reduced by treatment of 200 mg kg⁻¹ of *Camellia sinensis*. LDL and VLDL levels were significantly increased in triton injected animals to control rats. The results were shown in Table 1, 2, 3 and 4. The SG markedly lowers the levels of serum cholesterol and VLDL. The decrease in cholesterol may indicate increased oxidation of

mobilized fatty acids of inhibition or lipolysis. 15 animals were grouped into 3 groups each containing 5 animals.

Group-1- Control

Group-2- Triton treated control

Group-3- Triton + SG (200 mg kg⁻¹)

The SG extract was administered orally for 7 days daily. The present investigation shows that all triton induced rats displayed hyperlipidemia as shown by their elevated levels of serum and liver cholesterol, triglyceride, PL, VLDL, LDL and also the reduction in the HDL level. It can be concluded that SG 200 mg kg⁻¹ treatment was effective in cholesterol, PL, TG, VLDL, LDL and HDL.

Table 4. Effect of aqueous extract of SG on HDL, LDL and VLDL in Liver of Control and Experimental Rats

Parameters	HDL	LDL	VLDL
Group-I control	29.99 ± 1.14	22.52 ± 0.38	12.21 ± 0.38
Group-II Triton treated	67.23 ± 0.67 ^a	176.20 ± 0.51 ^a	21.51 ± 0.51 ^a
Group-III Triton + SG (200 mg kg ⁻¹)	60.92 ± 2.01 ^b	19.90 ± 3.06 ^b	18.09 ± 0.68 ^b
Group-IV Triton + Fenofibrate	40.46 ± 3.9 ^b	20.91 ± 2.1 ^b	14.56 ± 1.5 ^b

Values are in mean ± SD; Number of animals in each group = 5; ^a p < 0.001 Vs Group I; ^b p < 0.001 Vs Group II

Discussion

Several studies reveal that an increase in HDL cholesterol and decrease in TC, LDL cholesterol and TG is associated with a decrease in the risk of ischemic heart diseases (19). Most of the antihyperlipidemic drugs are causing significant reduction in both TC and HDL cholesterol levels [20].

Triton Wr-1339 has been widely used to block clearance of triglyceride-rich lipoproteins to induce acute hyperlipidemia in several animals

[21]. This model is widely used for a number of different aims [22] particularly, in rats it has been used for screening natural or chemical hypolipidemic drugs [23]. Interestingly, the results of the present study show that extract of *Sesbania grandiflora* produced a significant reduction in cholesterol level and also it reversed Triton induced hypolipidemic in rats.

Schurr et al demonstrated that a parenteral administration of a dose of TritonWr-1339 to

adult rats induced hyperlipidemia. Our present study clearly show that aqueous *Sesbania grandiflora* extract at a dose of 200mg/kg significantly lowered both plasma triglycerides and cholesterol levels. The large increase in plasma cholesterol and triglycerides due to Triton Wr-1339 injection results mostly from an increase of VLDL secretion by the liver accompanied by a strong reduction of VLDL and LDL catabolism [24].

The reduction of total cholesterol by the *Sesbania grandiflora* extract was associated with a decrease of its LDL fraction, which is the target of several hypolipidemic drugs. This result suggests that cholesterol-lowering activity of the herb extract can be result from the rapid catabolism of LDL cholesterol through its hepatic receptors for final elimination in the form of bile acids as demonstrated by Khanna et al [25].

In the fact, flavonoids and anthocyanins, a heterogenous group of ubiquitous plant polyphenols, have exhibited a variety of pharmacological activities, including the anti-atherogenesis and antioxidant effect [26]. Furthermore, quantification of tannins, proanthocyanidins and flavonoids contents in plant samples confirmed the results reported by Bruneton et al [27] showing that these phenolic fractions represent major compounds of *Sesbania grandiflora* leaves. The results strongly suggest that the hypolipidemic activity of this medicinal plant could be attributed to the presence of the valuable polyphenolic compounds. Increase in plasma lipid, cholesterol and triglycerides levels is related to significant changes in lipid metabolism and structure [28]. Abnormalities in cellular cholesterol metabolism could partly be responsible for the changes in the plasma cholesterol levels in diabetes [29]. Diabetes is also associated with hyperlipidemia. Serum total cholesterol and triglycerides have been decreased significantly in diabetic rats after extract supplementation. These effects may be due to low activity of cholesterol biosynthesis enzymes and / or low-level lipolysis that are under the control of insulin [30]. This extract supplementation also resulted in significant

attenuation in the level of LDL and HDL in serum towards the control level, which again strengthens the hypolipidemic effect of this extract.

The antihyperlipidemic activity of *Sesbania grandiflora* (200 mg kg⁻¹) against Triton Wr-1339 showed equipotent activity when compared to fenofibrate treated groups. Thus, our study showed that administration of aqueous extract of 200 mg kg⁻¹ of *Sesbania grandiflora* was more effective to manage hyperlipidemia. The active ingredients present here may recover the disorders in lipid metabolism noted in hyperlipidemic state.

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