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Hypolipidemic Efficacy of *Achyranthes aspera* on Lipid Profile in Sesame oil fed Rats

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ABSTRACT: The present study was designed to evaluate the antihyperlipidemic effect of aqueous extract of *Achyranthes aspera* a in experimental rats fed with diet containing sesame oil. Hyperlipidemia and the effect of Achyranthes aspera in experimental rats were studied by assessing parameters such as cholesterol, phospholipids, freefattyacids and triglycerides in serum, liver, and heart and kidney tissues. The levels of HDL, LDL, VLDL and atherogenic index were assessed. Hyperlipidemia in experimental rats were evidenced by a significant enhancement in the levels of cholesterol phospholipids, freefattyacids and triglycerides in serum, liver heart and kidney tissues by atherogenic diet feeding. A significant fall in HDL in both Anjali and Idhayam oil treated groups were observed in serum. These values retrieved towards normalcy in *Achyranthes aspera* treated groups. This study unveiled the antihyperlipidemic activity of *Achyranthes aspera*.

Keywords: *Achyranthes aspera,* Atherogenic, Hyperlipidemia, Phospholipids, Sesame Oil.

INTRODUCTION

Hypercholesterolemia refers to levels of cholesterol in the blood that are higher than normal. Hypercholesterolemia increases the risk of heart disease. Elevated levels of circulating cholesterol cause deposits to form inside blood vessels. These deposits, called plaque, are composed of fats deposited form the bloodstream. When the deposits become sufficiently large, they block blood vessels and decrease the flow of blood. These deposits result in a disease process called atherosclerosis, a disease process whereby plaques of fatty substances are deposited inside arteries, reducing the inside diameter of the vessels and eventually causing damage to the tissues located beyond the site of the blockage, which can cause blood clots to form that will ultimately stop blood flow. If this happens in the arteries supplying the heart, a heart attack will occur. Atherosclerosis causes more deaths form heart disease than any other single condition.[1].

Traditional medicine refers to health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral bases medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain well- being [2]. Herbals which have been used by people for thousands of years have great potential for use in modern days. Herbal drugs have got tremendous momentum in the global health care system[3]. *Achyranthes aspera* belongs to the family of Amaranthaceae. It is a perennial herb with 1-3 feet height, often woody below. Whole plant possesses medicinal property, which include astringent, diuretic, expectorant etc.,[4] Sesame seed oil has been an inherent part of the lives of the people of Tamilnadu since time immemorial. *Sesamum indicum* has been identified to possess immense medicinal properties not only by ancient Ayurvedic texts, but also by traditional medicinal practitioners [5]. The present study focuses to determine the effectiveness of *Achyranthes aspera* on lipid profile in sesame oil fed rats.

MATERIALS ANS METHODS:

Animals

Male albino rats of Wister strain weighing 150-200g were procured from small Animal's breeding centre of Kerala Agricultural University, Mannuthy, Thrissur. The animals were housed in spacious cages and fed with standard pellet diet supplied by AVM foods, Coimbatore, Tamilnadu, India. Food and water were provided ad *libitium*. A week's time was allowed for the animals to get acclimatized to the laboratory conditions. The experiments were carried out as per the institutional Ethics committee.

Chemicals

All the chemicals used in the present study were of analytical regent grade. HDL was determined by using a commercially available regent Kit obtained from Span Diagnostics, India.

Plant Material

Fresh seeds of *Achyranthes aspera* were collected from the wild during the month of August –November 2005. Taxonomic authentication was done by the Department of Botany, Kongunadu Arts and Science College, Coimbatore, Tamilnadu, India.

Preparation of Plant Extract

Aqueous extract was prepared by collecting fresh seeds of Achyranthes aspera and grinding one part of the seed with then parts of water.

Selection of Oils

Locally available and widely used brands of sesame oil namely ANJALI and IDHAYAM were used for the study.

Atherogenic Diet

The diet given for the experimental animal constituted;

Wheat flour	- 15g
Roasted Bengal Gram Flour	- 58g
Groundnut Flour	- 10g
Milk Powder	- 5g
Health Mix	- 4g
Salt	- 4g
Sesame oil	- 4g

Every day the feed for each animal was weighed separately, transferred into a separate container and mixed with sufficient water and steamed to a semisolid consistency. The feeding was continued for a period of 45 days.

Experimental Procedure

After one week adaptation period, the animals were divided into five groups with six animals in each group.

Group I: Served as normal control rats

Group II: Rats fed with diet containing 6g/kg/BW of Anjali gingerly oil for 45 days

Group III: Rats fed with diet containing 6g/kg/BW of Idhayam gingerly oil for 45 days

Group IV: Rats fed with 1.33g/kg/bw of aqueous plant extract in addition to 6g/kg/BW of Anjali gingerly oil for 45 days

Group V: Rats fed with 1.33g/kg/bw of aqueous plant extract in addition to 6g/kg/BW of Idhayam gingerly oil for 45 days.

At the end of the experimental period, the rats were deprived of food overnight and then sacrificed by cervical dislocation. Blood was collected by an incision made in the jugular veins. Serum was prepared from the collected blood. Liver, heart and kidney tissues were dissected out, blotted off blood, rinsed in phosphate buffered saline (PH 7.4) and then lipids were extracted for further studies.

Analytical Procedure

The levels of cholesterol[6], triglycerides[7], phospholipids[8], freefattyacids[9] and HDL were estimated in serum. The levels of LDL, VLDL and atherogenic index were calculated using the formulae[10],

LDL= Cholesterol – (HDL+VLDL)
VLDL= Triglycerides/5
Atherogenic index = (LDL+VLDL)/HDL

Tissue lipids were extracted[11] and estimated for cholesterol, triglycerides, phospholipids and freefattyacids.

Statistical analysis

The results were presented as mean= SD. One way Analysis of Variance (ANOVA) was performed to analyze statistical significance of the data [12].

RESULTS

Table I depicts the levels of serum lipid profile in experimental rats. These biochemical variables were significantly elevated in Anjali and Idhayam oil treated groups. Earlier studies have reported negative associations between HDL cholesterol and cardiovascular disease in several populations. The levels of lipid profile in liver, heart and kidney tissues of rats in comparison with those of control and experimental rats are illustrated in table II, III and IV. Atherogenic diet feeding increased cholesterol, phospholipids, triglycerides and freefattyacids in liver, heart and kidney tissues. Atherogenic feed supplementation with Achyranthes aspera treatment had a beneficial affect in reverting these conditions to normalcy. It was noticed that there was no significant difference between Anjali oil and Idhayam oil.

The findings of the present study are similar to various other studies conducted in different parts of the world (13,14,15,16,and 17).

DISCUSSION

This study reveals that consumption of high fat diet causes a condition called hyperlipidemia, manifested by enhanced levels of cholesterol, phospholipids, triglycerides and freefattyacids in serum and tissues. Hyperlipidemia wvokes oxidative damage in various tissues, which in turn, deregulates the cellular functions leading to various pathological conditions [(15).]

Hyperlipoproteinemia with increased concentration of cholesterol and triglycerides carrying lipoproteins is considered to be the cause of arteriosclerosis with its duel sequel of thrombosis and infarction. HDL promotes the removal of cholesterol form peripheral cells and facilitates its delivery back to the liver. Therefore increased levels of HDL in Achyranthes aspera treated groups are desirable on contrary, high levels of VLDL and LDL in Anjali and Idhayam oil fed groups promote arteriosclerosis[(18)].

Serum LDL cholesterol is higher because VLDL is precursor of LDL and raised VLDL may lead to increased LDL levels associated with decrease in LDL catabolism. This decrease may be due to enhanced LCAT (Lysolecithin acyltransferase) which also causes hypertriglyceridemia in LDL rich cholesterol and phospholipids the enhanced LCAT activity promoted the transfer of activated fatty acids to cholesterol resulting in formation of lysoleclthin which in turn causes triglyceride formation[(19)].

A rise in LDL may cause deposition of cholesterol in the arteries and aorta and hence it is a direct risk factor of coronary heart disease. The search for hypolipidemic drugs follows rationale that high levels of serum cholesterol are associated with an increase in incidence of coronary heart disease. Reduction in LDL and increase in HDL concentration in *Achyranthes aspera* treated groups are signs related to lipid lowering therapy [(20)].

The decrease in triglycerides in *Achyranthes aspera* treated groups in an important finding of this experiment. Recent studies show that triglycerides are independently related with coronary heart disease. Most of the hypolipidemic drugs do not decrease triglyceride level but Achyranthes aspera treatment lowered it significantly [(20)].

The atherogenic index was significantly reduced in *Achyranthes aspera* treated groups. These results demonstrate strong hypolipidemic impacts of *Achyranthes aspera*. It also provides additional benefits in the prevention and treatment of arteriosclerosis.

To conclude, atherogenic feed supplementation with *Achyranthes aspera* reduced the hyperlipidemic and hypercholesteremic conditions. *Achyranthes aspera* appeared to ameliorate hypercholesteremia probably by decreasing the exogenous cholesterol absorption and increasing the endogenous cholesterol conversion to bile acid. Thus *Achyranthes aspera* seems to be a promising plant in respect of its hypolipidemic potential, and it necessitates further studies to isolate the antihyperlipidemic principle of this plant.

Table I :Effect of Achyranthes aspera on serum lipid profile in Sesame oil fed Rats

GROUPS	Cholesterol (mg/dl)	Phospho lipids (mg/dl)	Free fatty acids (mg/dl)	Triglyceride (mg/dl)	VLDL (mg/dl)	HDL (mg/dl)	LDL (mg/dl	Athero genic index
Group I Control	90.4 ±3.4	174.2 ±3.9	26.32 ±2.5	75.3 ±2.4	15.06 ±1.4	38. 2 ±3.2	37.14 ±3.2	1.37 ±0.3
Group II Anjali Oil	140.8 ±7.3$^{\varepsilon}$	208.4 ±4.4$^{\varepsilon}$	50.21 ±5.1$^{\varepsilon}$	113.4 ±5.2$^{\varepsilon}$	22.68 ±2.3$^{\varepsilon}$	14.3 ±1.2$^{\varepsilon}$	103.82 ±7.3$^{\varepsilon}$	8.84 ±2.4$^{\varepsilon}$
Group III Idhayam Oil	148.3 ±8.2$^{\varepsilon}$	214.1 ±4. 9$^{\varepsilon}$	54.32 ±5.3$^{\varepsilon}$	120.2 ±6.7$^{\varepsilon}$	24.04 ±2.6$^{\varepsilon}$	15.6 ±1.4$^{\varepsilon}$	108.66 ±7.5$^{\varepsilon}$	8.51 ±2.6$^{\varepsilon}$
Group IV Anjali Oil +A.a	110.1±6.4$^{x\Omega}$	183.2±3.8$^{x\Omega}$	36.33±3.9$^{x\Omega}$	86.2±3.2$^{x\Omega}$	17.24±1.6$^{x\Omega}$	29.2±2.1$^{x\Omega}$	63.66±5.4$^{x\Omega}$	2.77±1.4$^{x\Omega}$
Group V Idhayam Oil +A.a	119.4±5.6$^{x\ell}$	189.4±3.6$^{x\ell}$	39.41±4.2$^{x\ell}$	90. 6±3.9$^{x\ell}$	18.12±1.9$^{x\ell}$	31.3±2.6$^{x\ell}$	69.9±6.6$^{x\ell}$	2.81±1.7$^{x\ell}$

Values are expressed as mean± SD (n=6)
$^{\varepsilon}$ Significant at P<0.05 compared to control
^{x} Significant at P<0.05 compared to Group II &III
$^{\&!}$Significant at P<0.005 compared to Group II
$^{-!}$Significant at p<0.005 compared to Group III

A.a – *Achyranthes aspera*

Table II: Effect of Achyranthes aspera on liver lipid profile in Sesame oil fed Rats

GROUPS	Cholesterol (mg/dl)	Phospholipids (mg/dl)	Free fatty acide (mg/dl)	Triglycerides (mg/dl)
Group I Control	7.1 ± 1.2	25.3 ± 2.3	285.6±12.3	421.6±11.2
Group II Anjali Oil	12.4 ± 1.4 $^{\varepsilon}$	40.2 ± 3.4 $^{\varepsilon}$	301.3±13.2 $^{\varepsilon}$	460.3±13.4 $^{\varepsilon}$
Group III Idhayam Oil	13.2 ± 1.3 $^{\varepsilon}$	42.3 ± 3.1 $^{\varepsilon}$	306.2±14.2 $^{\varepsilon}$	458.2±13.3 $^{\varepsilon}$
Group IV Anjali Oil + A.a	8.3 ± 2.1$^{x\Omega}$	28.4±2.6 xΩ	293.4±12.9 xΩ	432.4±12.6 xΩ
Group V Idhayam Oil + A.a	8.7±1.8$^{x\ell}$	29.6±2.8 $^{x\ell}$	295.6±11.3 $^{x\ell}$	435.2±11.9 $^{x\ell}$

Values are expressed as mean±SD (n=6)
[ε]Significant at P<00.5 compared to control
[&!]Significant at p<0.05 compared to Group II
[χ]Significant at P<0.05 compared to Group II &III
[-!]Significant at P<0.05 compared to Group III

A.a – *Achyranthes aspera*

Table III: Effect of Achyranthes aspera on Heart lipid profile in Sesame oil fed Rats

GROUPS	Cholesterol (mg/dl)	Phospholipids (mg/dl)	Free fatty acide (mg/dl)	Triglycerides (mg/dl)
Group I Control	119.3 ± 6.3	3.8 ± 1.2	176.3 ± 7.3	47.4±2.3
Group II Anjali Oil	140.1 ± 7.2 [ε]	6.2 ± 2.4 [ε]	199.2± 8.2 [ε]	70.4±2.1 [ε]
Group III Idhayam Oil	144.5 ± 7.5 [ε]	6.6 ± 2.6 [ε]	198.3±8.3 [ε]	73.1±2.4 [ε]
Group IV Anjali Oil + A.a	124.3 ± 6.2[χ?]	4.3±1.5[χ?]	186.2± 6.2[χ?]	58.2 ±3.2[χ?]
Group V Idhayam Oil + A.a	127.6±6.1[χ?]	4.7±1.3[χ?]	188.3±6.4[χ?]	61.3±3.7[χ?]

Values are expressed as mean ±SD (n=6)
[ε] Significant at P<0.05 Compared to control
[χ]Significant at P<0.05 Compared to group II&III
[&!]Significant at P<0.05Compared to group II
[-!]Significant at P<0.05 Compared to group III

A.a – *Achyramthes aspera*

Table IV : Effect of Achyranthes aspera on Kidney lipid profile in sesame oil fed rats

GROUPS	Cholesterol (mg/dl)	Phospholipids (mg/dl)	Free fatty acide (mg/dl)	Triglycerides (mg/dl)
Group I Control	8.9 ± 1.2	17.1 ± 3.2	115.1±7.1	113.2±6.3
Group II Anjali Oil	12.3 ± 1.3 [ε]	25.3 ± 2.4 [ε]	142.3±6.3 [ε]	156±5.6 [ε]

Group III Idhayam Oil	11.4 ± 1.1 [ε]	26.2 ± 2.5 [ε]	146.5±7.2 [ε]	154.2±5.4 [ε]
Group IV Anjali Oil + A.a	9.5 ± 0.8 [x?]	19.4± 1.8[x?]	121.0±5.1[x?]	131.3±3.2[x?]
Group V Idhayam Oil + A.a	9.7± 0.9[x?]	18.3±1.7[x?]	122.3±15.2[x?]	128.4±2.8[x?]

Values are expressed as mean ±SD (n=6)
[ε] Significant at P<0.005 compared to control
[x]Significant at P<0.005 compared to group II &III
[&!]Significant at P<0.05 compared to group II
[-!]Significant at P<0.05 compared to group III

A.a - *Achyranthes aspera*

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