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ANTI-HYPERLIPIDEMIC ACTIVITIES OF MODIFIED DIET IN RATS FED WITH HIGH FAT DIET

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ABSTRACT

The aim of the present study was to investigate the evaluate anti-hyperlipidaemic activity of modified diet in rats fed with high fat diet. The elevated levels of total cholesterol, phospholipids, triglycerides and low-density lipoprotein due to HFD. Administration of modified diet was significantly (*P<0.001*) reduced the lipid profile and lipoprotein levels. A significant reduction in HDL-cholesterol was noticed in HFD fed groups (II); however, a significant increased the HDL level was produced by the administration of modified diet. Therefore, it was concluded that modified diet has definite cardio protective effect against hyperlipidemia.

Keywords: Modified diet, hyperlipidemic effect, HFD.

INTRODUCTION:

Atherosclerosis, the most important pathologic process leading to cardio- and cerebrovascular diseases, is suggested to be mediated by the increase in the serum lipid, thrombosis, and injuries of the endothelial cells[1,2]. Generally the therapeutic purpose of using hypolipidemic drugs is to reduce the elevated levels of plasma lipids, notably cholesterol established[3].Some of the major limitations in the effective pharmacological treatment of hyperlipidemia are the constraints imposed on health care resources, particularly in the low-and middle-income countries[4]. There is a need to tackle this physiological problem as it is attaining grave proportions globally. In recent times, much research interest has been focused on modified diets that possess hypolipidemic properties that may be useful in reducing the risk of cardiovascular diseases[5].

MATERIAL AND METHODS

Animal diet

The compositions of the two diets were as follows[6]: ***Control diet:*** Wheat flour 22.5%, roasted bengal gram powder 60%, skimmed milk powder 5%, casein 4%, refined oil 4%, salt mixture with starch 4% and vitamin & choline mixture 0.5%. ***High fat diet:*** Wheat flour 20.5%, roasted bengal gram 52.6%, skimmed milk powder 5%, casein 4%, refined oil 4%, coconut oil 9%, salt mixture with starch 4% and vitamin & choline mixture 0.5%, cholesterol 0.4%.

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Animals and treatment

Male Wister rats of 16-19 weeks age, weighing 150-175g were procured from the Central Animal House, Sree Vidyanikethan College of Pharmacy, Tirupati. The animals were kept in cages, 2 per cage, with 12:12 hr light and dark cycle at $25^0 \pm 2^0$C. The animals were maintained on their respective diets and water *ad libitum.* Animal Ethical Committee's clearance was obtained for the study. Animals were divided into following 4 groups of 6 animals each:

Experimental Design

Group I : Standard chow diet (Control).
Group II : High Fat Diet.
Group III : High fat diet + Modified diet
Group IV : High fat diet + Standard drug atorvastatin (1.2 mg/kg b.w.)

The modified diet as well as standard atorvastatin were suspended in 2% tween 80[7] separately and fed to the respective rats by oral intubation. Rats of groups III and IV were orally fed with modified diet and standard drug atorvastatin. At the end of 9 weeks all the animals were sacrificed by cervical dislocation under light ether anesthesia. Blood was collected retro-orbitally from the inner canthus of the eye using capillary tubes in fresh in heparinised tubes and plasma was separated.

Biochemical estimation

Plasma samples were analyzed for total cholesterol, triglycerides, phospholipids and HDL-cholesterol by using Boehringer Mannheim kits by Erba Smart Lab analyzer USA. LDL-cholesterol was calculated by using Friedwald method[8].

STATISTICAL ANALYSIS

The results are expressed as mean ± SEM. Comparison between the treatment groups and control were performed by one-way analysis of variance (ANOVA) followed Turkeys multiple Comparison tests.

RESULTS AND DISCUSSION:

Plasma Lipid Profile

Table-1 shows the effect of modified diet on plasma lipid profile in control and experimental rats in each group. Total cholesterol levels were increased in high fat diet fed rats (group II) as compared to control rats (group I). Results show that treatment with high fat diet significantly ($p<0.001$) increased the concentration of plasma lipids as reported earlier revealing that significant elevation of plasma lipid parameters in response to atherogenic diet and cholesterol feeding[9]. Treatment of modified diet to rat fed with HFD significantly ($p<0.001$) decreased in the concentration of total cholesterol as compared to HFD rats (group II). Administration of modified diet treated rats with HFD had showed that plasma cholesterol levels were restored to near normal as that of atorvastatin.

Effect of the modified diet on plasma triglyceride and phospholipids are presented in Tables-1. The concentration of plasma triglyceride and phospholipids was elevated in rats fed with high fat diet (group II) as compared to control rats (group I). HFD rats had significant increase in the level of plasma triglyceride due to decrease in the activity of lipoprotein lipase[10]. The plasma triglyceride and phospholipids levels were reduced in rats treated with modified diet and as well as standard drug atorvastatin along with HFD when compared with rats fed with high fat diet (group II). The plant extract may have stimulation of lipoprotein lipase activities resulting in decrease of plasma triglyceride and might increase the uptake of triglyceride from plasma by skeletal muscle and adipose tissues[11]. The reduced concentration of phospholipids may also be due to the enhanced activity of phospholipases[12].

Table 1: Effect of modified diet on plasma lipid profile in control and experimental rats in each group.

Groups	Total cholesterol (mg/dl)	Phospholipid (mg/dl)	Triglyceride (mg/dl)
Group I	112.98±0.04 ^{b*}	107.76 ±0.98 ^{b*}	81.02 ±0.17 ^{b*}
Group II	175.36±0.44 ^{a*}	145.48 ±0.42 ^{a*}	150.12 ±0.17 ^{a*}
Group III	101.12 ±0.75 $^{a*, b*}$	106.16 ±0.63 $^{a**, b*}$	79.10±0.74 $^{a*, b*}$
Group IV	99.85 ±0.11 $^{a*, b*}$	108.07 ±0.42 $^{a*, b*}$	74.41 ±0.96 $^{a*, b*}$

Values are expressed as mean ± SE (n=6 rats), *P* values : * < 0.001, ** < 0.05

NS: Non Significant;

a → group I compared with groups II, III & IV.

b → group II compared with groups I, III & IV.

Plasma Lipoprotein Profile

Table-2were shows the levels of HDL cholesterol in plasma of control and experimental rats in each group. The HDL cholesterol levels increased in high fat diet rats (Group II) as compared to control rats (group I). Administration of modified diet had significantly raised the levels of HDL-cholesterol levels than that of other extracts treatment groups. The increased HDL-C facilitates the transport of TG or cholesterol from serum to liver by a pathway termed 'reverse cholesterol transport' where it is catabolised and excreted out of the body.

Effect of modified diet on plasma LDL-cholesterol levels was depicted in table-3. HFD fed rats (group II) are elevated levels of LDL-cholesterol when compared with control rats (group I). The increase in the concentrations of LDL observed is mainly due to the dietary carbohydrates and cholesterol[13]. Studies show that both LDL have a positive role in atherogenesis. Treatment of modified diet markedly reduced the levels of LDL-cholesterol. Reduced levels of LDL-cholesterol in modified diet on HFD fed rats may be possibly due to increase with catabolism of LDL.

Table 2: Effect of modified diet on plasma lipoprotein in control and experimental rats in each group

Groups	HDL cholesterol (mg/dl)	LDL cholesterol (mg/dl)
Group I	59.17±0.02 ^{b*}	36.61±0.13 ^{b*}
Group II	37.41±0.17 ^{a*}	99.22 ± 0.63 ^{a*}
Group III	57.42±0.71 $^{a*, b*}$	26.12 ±0.47 $^{a*, b*}$
Group IV	56.04 ±0.55 $^{a*, b*}$	27.24 ±0.73 $^{a*, b*}$

Values are expressed as mean ± SE (n=6 rats), *P* values : * < 0.001, ** < 0.05

NS : Non Significant

a → group I compared with groups II, III & IV.

b → group II compared with groups I, III & IV.

CONCLUSION:

The concentrations of cholesterol, phospholipid, triglyceride and LDL were significantly increased and HDL level was significantly decreased in plasma of rats fed HFD when compared with the control group of rats. Plasma cholesterol, phospholipid and triglyceride were elevated in rats treated with HFD. Administering the modified diet along with HFD significantly reduced both plasma lipid level and significantly increased HDL level in plasma.

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