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Research Article

A Study of Antiobesity, Hypolipidemic and Anti-Atherogenic Activity of Poly Herbal Formulation against High Fat Diet-Induced Obesity in Albino Rats

Amit Agrawal[1], Rishikesh Sharma[2]

[1,2]Bhabha Pharmacy Research Institute, Bhopal, Madhya Pradesh, India.

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Corresponding Author:
Amit Agrawal, Bhabha Pharmacy Research Institute, Bhopal, Madhya Pradesh, India.
E-mail Id:
akagrawal1981@gmail.com
Orcid Id:
https://orcid.org/0000-0002-6347-6132
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A B S T R A C T

Obesity is one of the most common health problems and has become an epidemic on the global scale. Hyperlipidaemia is one of the greatest risk factors contributing to atherosclerosis and occurrence of coronary heart diseases from the first human civilization, research is going to find the drugs to treat obesity and its complications. Despite availability of many drugs in market to treat obesity, no single drug is ideal for treating all sorts of problems caused by obesity. So the research is going on finding perfect drug. In the present study was aimed to evaluate Antiobesity, Hypolipidemic and Anti-Atherogenic activity of polyherbal formulations fruit of *Emblica officinalis*, Rhizome of *Curcuma Longa* & Leaves of *Gymnema sylvestre* in high fat fed albino rats. Obesity was induced in wistar albino rats by feeding them with high fat diet for 25 days. Group-I served as normal control (1% Carboxy Methyl Cellulose (CMC)) and Group-II as obese control (1% CMC) fed on high fat diet, Group- III, IV were treated with various polyherbal formulations, Group-V served as positive standard (Orlistat 50 mg/kg body wt.). Hyperlipidaemia was induced by feeding animals with high fat diet per orally, consisting of coconut oil and Vanaspati ghee, daily *ad libitum* except normal control. The animals were treated for 14 days. At the end of the study, blood samples of the animals were sent for the estimation of the lipid profile and effects of test drug studied by comparing levels of the body weight, Total Cholesterol, Triglycerides, HDL, LDL, and Atherogenic index. The statistical significance between groups was analysed. There was a significant reduction in food intake, body weight, TC, TG, LDL and an increase in HDL levels in high fat diet fed rats treated Polyherbal formulation containing *Emblica officinalis*, Rhizome of *Curcuma Longa* & Leaves of *Gymnema sylvestre* as compared to the Positive Standard and Normal treated animals.

Keywords: Antiobesity, Atherogenic Index, *Curcuma Longa*, *Emblica Officinalis*, *Gymnema sylvestre*, Hypolipidemic, Orlistat

Introduction

Hyperlipidaemia is a disorder of lipid metabolism manifested by elevation of serum concentrations of the various lipid and lipoprotein levels, which is the key risk factor for Cardiovascular Disorders (CVD).[1,2] Obesity is becoming one of the most prevalent health concerns among all populations and age groups worldwide, resulting in a significant increase in mortality and morbidity related to Coronary heart diseases, Diabetes Type 2, Metabolic syndrome, Stroke and Cancer.[3,4] Atherosclerosis is an age related disease. It is widely prevalent in industrialized countries, affecting primarily the intima of large and medium sized arteries and is characterized by fibrous-fatty plaques or atheroma.[5] Plant-based pharmaceuticals have been employed in the management of various diseases affecting humans.

Gymnema sylvestre (Asclepiadaceae), known as "gurmar" for its distinct property as sugar destroyer, is a reputed herb in the Ayurvedic system of medicine. The phytoconstituents responsible for sweet suppression activity includes triterpene saponins known as gymnemic acids. It has been used in the treatment arthritis, diuretic, anemia, osteoporosis, hypercholesterolemia, asthma, constipation, microbial infections and anti-inflammatory.[6-8]

E. Officinalis (Amla, Indian Gooseberry) is an evergreen tree which is highly prized in tropical Asia. Apart from traditional uses, there are several reports in the pharmacological actions of Amla based on modern scientific investigations, especially anti-inflammatory action, antimicrobial action, anti-oxidant action, anticarcinogenic action, anti-ulcerogenic action, anti-diabetic action, analgesic action and hepato protective action.[9-11]

Curcuma longa is extensively used anti-inflammatory, antioxidant, anticarcinogenic, antimutagenic, anticoagulant, antifertility, antidiabetic, antibacterial, antifungal, antiprotozoal, antiviral, antifibrotic, antivenom, antiulcer, hypertensive and hypercholesteraemic activities.

The literature survey reveals that *Gymnema sylvestre* has weight reducing activity, E. Officinalis has cholesterol lowering property while *Curcuma longa* is a well-known antioxidant agent.[12,13] Thus, in the present study, an attempt has been made to evaluate Antiobesity, Hypolipidemic and Anti-Atherogenic activity of polyherbal formulations containing fruit of *Emblica officinalis*, Rhizome of *Curcuma Longa* & Leaves of *Gymnema sylvestre*.

Materials and Methods

Selection, Collection and Authentication of Plant/ Plant Material

The different fresh plant parts viz., leaves of *Gymnema sylvestre*, rhizomes of *Curcuma longa*, and fruits of *Embilica officinalis* were collected in the months Jan 2017 to March 2017 from the in and around local areas of Bhopal District of M.P. and identified & authenticated by Dr. Zia Ul Hasan, Professor, Head Dept. of Botany, Safia College of science, Bhopal, M.P., dated 22/04/2017. M.P. and were deposited in Laboratory, Voucher specimen No. 470/ Bot/ Safia/ 2017 for leaves of *Gymnema sylvestre,* 469/ Bot/ Safia/ 2017 for fruits of *Embilica officinalis,* and 466/ Bot/ Safia/ 2017 for rhizomes of *Curcuma longa.* After authentication the plant parts were washed, shade dried and crushed to obtain coarse powder

Chemicals and Reagents

Total Cholesterol estimation kit (enzymatic method), HDL, cholesterol (precipitation and enzymatic method) and triglycerides (enzymatic method) estimation kits (manufactured by Sigma diagnostics (India) PVT. Ltd, Baroda) were procured from Jyoti Chemicals, Bhopal, India. Orlistat was obtained as gift sample from Franco-Indians, Mumbai.

Extraction

Dried fruit of *Emblica officinalis*, Rhizome of *Curcuma Longa* & Leaves of *Gymnema sylvestre* were extracted with 90% alcohol by maceration. The crude extracts were concentrated and dried under reduced pressure. The dry extracts were stored in airtight containers and used for further studies.

Animals

Albino rats of Wistar strain, belonging to either sex, weighing between 150-200 g were used in the study. They were housed under standard environmental conditions and fed with commercial diet and water *ad libitum*. They were maintained in a controlled environment (12:12 h light/ dark cycle) and temperature (30±2 ºC). The experimental protocol was approved by the Institutional Animal Ethical Committee.

Acute Toxicity Studies

Healthy wistar albino rats (180-250 gm), starved overnight were divided into four groups (n=6) and were orally fed with the extracts in increasing dose levels of 100, 500, 1000 and 2000 mg/ kg body weight.[14] The rats were observed continuously for 2 h for behavioral, neurological and autonomic profiles and after 24 and 72 for any lethality.

Dose Selection

The polyherbal formulation of the three herbs (viz. *Gymnema sylvestre* R, *Curcuma Longa*, *Embilica officinalis*.) was prepared according to their effective doses ED_{100}. In the present study, two doses of the polyherbal extract were selected as 200mg and 400mg/ kg, p.o. They were well mixed in 1% CMC till the stable and homogeneous suspension formed. Polyherbal formulation was quantitively

evaluated for any incompatibility by visible observation of precipitation.[15,16]

Preparation of High Fat Diet for inducing Hyperlipidaemia

Groups (II-V) were considered as model group and fed with High Fat Diet (HFD). The HFD consisted of 40 g of condensed milk and 40 g of bread, 15 g of chocolate and 30 g of biscuit and 30 g of dried coconut, and 40 g of cheese and 50 g of boiled potatoes. Food intake was calculated every day and body weight was measured once in every two days.

Study Design

The rats were divided into five different groups, containing six animals each.

Group I: Served as control kept under normal diet as normal control administered with vehicle (1% CMC) orally.

Group II: Served as the obese control administered with vehicle (1% CMC) orally.

Group III: Was treated with PHF (200 mg/ kg orally).

Group IV: Was treated with PHF (400 mg/ kg orally).

Group V: Was treated with 50 mg/ kg Orlistat orally in 1% CMC.

The treatment was given for 25days[17,19] On twenty-fifth day of the experiment, rats were anaesthetized by mild chloroform anaesthesia and blood was collected after keeping the animals for 12 hours fasting. Biochemical parameters including Cholesterol, Triglycerides, LDL and Liver Function parameters including Serum glutamate oxaloacetate transaminase, Serum glutamate pyruvate transaminase and Alkaline phosphatase were evaluated.[20, 21]

Atherogenic Index

The Atherogenic index was calculated by using the formula.[22]

Atherogenic Index=Total Cholesterol - HDL/ HDL

Statistics

The data for various biochemical parameters were analysed using analysis of variance (ANOVA) followed by student's 't' test. Values with $p < 0.05$ were considered statistically significant.

Result

The present study demonstrated hypercholesteraemic activity of Polyherbal Formulation in the wistar albino rats and efficacy was found to be significant. The oral administration of Polyherbal Formulation for a period of 25 days showed the significant changes in the Biochemical parameters. The evaluation of Cholesterol, triglycerides, and LDL levels were found to be elevated two-fold in the Disease Control Group when compared with the Healthy Control Group.

Similarly, the liver marker enzyme profile SGOT, SGPT and Alkaline Phosphatase levels were found to be significantly increased in the Disease Control Group over the Healthy Control Group.

Table 1.Lipid profile in polyherbal formulation treated experimental animals

Experiment groups	Total Cholesterol (mg dl) Mean±SEM	Triglycerides (mg/dl) Mean±SEM	HDL (mg/dl) Mean±SEM	LDL (mg/dl) Mean±SEM	VLDL (mg/dl) Mean±SEM	Atherogenic index ratio
Group I - Normal control	80.13±2.91	69.05±1.94	29.62±2.12	31.54±2.00	13.39±1.07	1.71±0.07
Group II - Negative control HFD	135.43±2.10	139.87±3.02	21.87±3.39	85.09±3.11	25.59±3.36	5.19±1.36
Group III - PHF 200 mg/ kg b.w. p.o	122.43±3.61*	106.98±3.14*	24.42±1.89*	71.98±2.11*	20.24±1.16*	4.01±1.06*
Group IV - PHF 400 mg/ kg b.w. p.o	115.5±2.81**	87.63±3.83**	25.91±2.98**	69.02±4.12**	17.36±2.15**	3.46±1.15**
Group V - Positive control Orlistat 50 mg/kg b.w. p.o	93.98±2.00***	75.91±3.85***	28.45±3.94**	46.67±3.987*	17.29±1.85**	2.30±1.15**

Values are expressed as Mean±SD. n=6 animals in each group. *p<0.05, ** p<0.01 when compared to Disease Control.

Table 2.Levels of liver function parameters polyherbal formulation treated experimental animals

Experiment groups	Serum Glutamate Oxaloacetate Transaminase (SGOT) (IU/L)	Serum Glutamate Pyruvate Transaminase (SGPT) (IU/L)	Alkaline Phosphatase (ALP) (IU/L)
Group I Normal control	125.70 ± 33	70 42.20 ± 11.70	76.20 ± 10.80
Group II Negative control HFD	148.30 ± 32.60*	74.30 ± 18.30*	69.80 ± 5.80
Group III PHF 200mg/kg b.w. p.o	128.40 ± 31.60*	40.40 ± 8.40*	56.0 ± 15.20*
Group –IV PHF 400mg/kg b.w. p.o	142.30 ± 36.80*	41.30 ± 6.28**	60.40 ± 12.20*
Group V Positive control Orlistat 50mg/kg b.w. p.o	138.70 ± 25.90	47.80 ± 13.80	51.0 ± 10.80*

Values are expressed as Mean±SD. n=6 animals in each group. *p<0.05, **p<0.01 when compared to Disease Control.

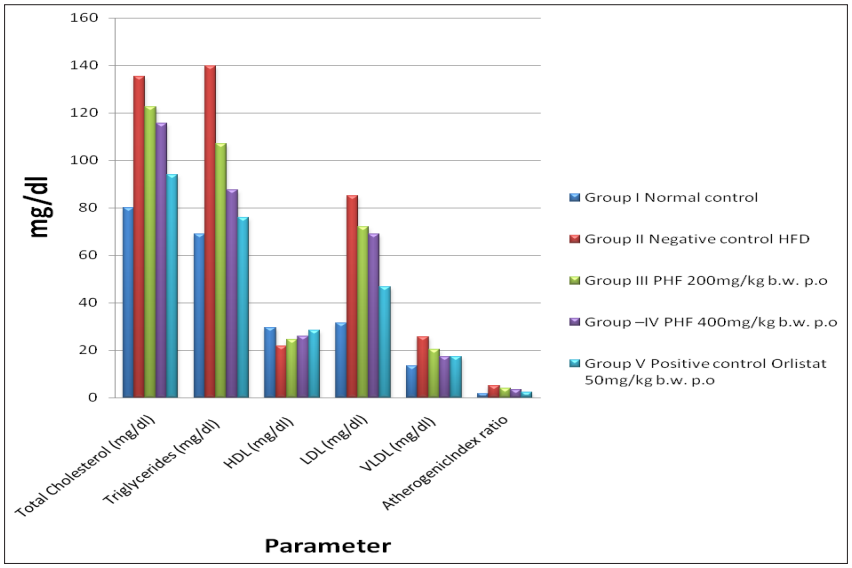

Figure 1.Lipid profile in polyherbal formulation treated experimental animals

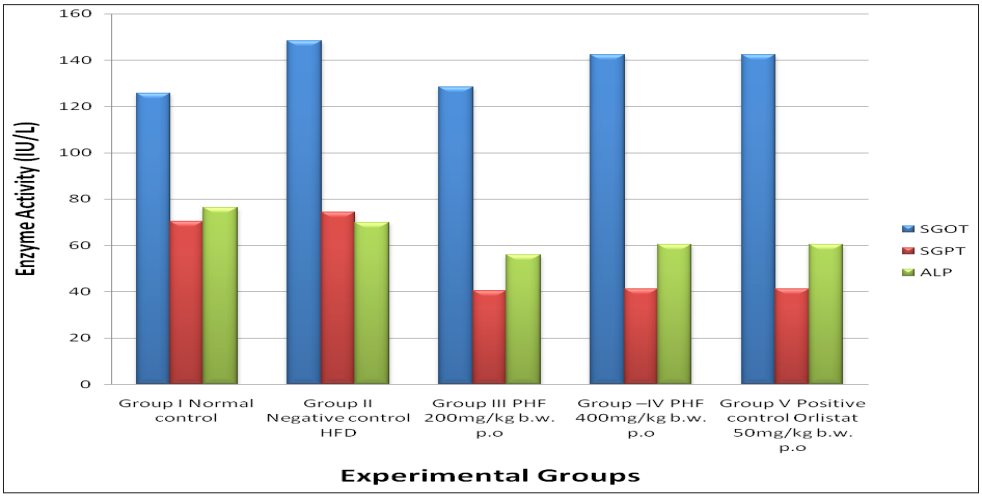

Figure 2.Levels of liver function parameters polyherbal formulation treated experimental animals

Discussion

With the urbanization and changed life-style there has been an alarming rise in the incidence and deaths caused by Coronary Heart Disease (CHD). The increased serum total cholesterol concentration and low-density lipoprotein

cholesterol concentration, decreased high density lipoproteins and some instances elevated triglyceride concentrations are the major risk factors. So, an important aim of the treatment of CHD is to improve lipid profiles.[23-25] In view of this, the research for hypolipidemic drug is assuming considerable importance especially on herbal products for the prevention and treatment of hypercholesterolemia. The present study showed that simultaneous administration of the polyherbal formulation along with cholesterol feeding brought about significant hypocholesterimic effect. The polyherbal formulation treated groups showed the prevention of elevation of cholesterol, triglyceride and LDL level in the test groups. At the prescribed dosage significant decrease in TG, TC, LDL, VLDL, SGOT, SGPT and ALP with increase in HDL levels. This may be attributed to the action of PHF 400mg/ kg BW p.o and Orlistat 50mg/ kg BW p.o. A significant increase in serum HDL levels in animals treated with PHF 400mg/ kg b.w.p.o was observed. Considering the enhancement of cardio protective lipid HDL, it can be concluded that the PHF is not only anti-obesity and anti-hyperlipidemia agent but also a cardio protective. PHF at 400mg/ kg B.W. p.o showed cardio protection by decreasing the atherogenic index and provided high % hyperlipidemia, which points out the reduction in risk against cardiovascular

Conclusion

From the overall result of the biochemical and behavioural results, it could be inferred that PHF showed anti-obesity Activity in High fat induced obesity models by showing protective activity.

Conflict of Interest: None

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