

**ANTILIPIDEMIC ACTIVITY OF *CISSUS QUADRANGULARIS* AND  
*TRIBULUS TERRESTRIS* ON OBESITY IN HIGH FAT FED RATS**

**Jiji.M.J, Visalakshi S, Meenakshi P, Rathi M.A., Thirumoorthi L,  
Chinna Guravaiah D. and Gopalakrishnan V.K \***

**Department of Biochemistry  
Karpagam University  
Coimbatore, India.**

**Summary**

The present study was designed to investigate the comparative effect of ethanol extract of *Cissus quadrangularis* and *Tribulus terrestris* on lipid profile in rats. Plant extract was orally administered to high fat fed rats (ghee + normal feed in the ratio 2:1) at a dose of 583 mg / kg body weight for 30 days. At the end of the experiment the animals were sacrificed and biochemical analysis of serum was performed for cholesterol, phospholipids, HDL and TG. The increased in cholesterol level, Phospholipids, HDL and TG were brought to some what normal by oral administration of *Cissus quadrangularis* and *Tribulus terrestris*. The histopathological examination of liver and heart showed positive result. The results of biochemical observations were supplemented by histopathological examination of rat's heart and liver section. The data suggested that oral administration with *Cissus quadrangularis* and *Tribulus terrestris* for 30 days has significantly antihyperlipidemic effect against high fat fed rats.

**Keywords:** obesity, high fat diet, *Cissus quadrangularis* and *Tribulus terrestris*

\* Corresponding author

Ph: 91-0422-2611146

Fax: 91-0422-2611043

Email: gopalakrishnan\_vk@yahoo.com.

### Introduction

Obesity is a serious health problem. Among the multiple factors contributing to its etiology, the sedentary life styles, white collar jobs, lack of exercise, psychological factors, and the consumption of energy rich diets are the major ones [1,2]. Due to obscure aetiology, the treatment of obesity is difficult and challenging. Further, the cause of concern is the non-availability of drugs for its treatment and the short-term efficacy and limiting side effects of the available drugs. Developing countries like India are also struggling to manage the impact of myocardial infarction along with the growing burden of obesity, Type II diabetes and hypertension [3]. In recent years, an increasing number of young Indians are succumbing to myocardial infarction due to unusual risk factors characterized by high triglycerides, low High Density Lipoproteins (HDL), glucose intolerance, insulin resistance, abdominal obesity and increased lipoprotein (a) levels [4,5]. Natural products have been the starting point for the discovery of many important modern drugs. This fact has led to chemical and pharmacological investigations and general biological screening programs for natural products all over the world [6]. In accordance with this approach are numerous investigations of the effectiveness of medicinal plants as natural supplements in reducing bodyweight, e.g., *Cissus quadrangularis* and *Tribulus terrestris*.

*Cissus quadrangularis* (CQ), a succulent vine native to West Africa and Southeast Asia, has been used in traditional African and Ayurvedic medicine for more than a century. Although some studies [7,8] have examined other uses of CQ, its role in fighting obesity and symptoms of metabolic syndrome has attracted interest in other parts of the world [9,10,11,12]. *Tribulus terrestris* is a more important ingredient of an Ayurvedic preparation. The decoction of leaves is useful as a gargle for mouth trouble, painful gum and reduces inflammation. Approximately 60-80% of World's Population still relies on traditional medicine for the treatment of common illness [13]. The present study was evaluated the anti-obesity effect of ethanolic extract of *Cissus quadrangularis* and *Tribulus terrestris* in high-fat diet consumed albino rats.

### Materials and methods

#### Plant material

The medicinal plants selected for the present investigation *Cissus quadrangularis* and *Tribulus terrestris* were collected from in and around Coimbatore and Pollachi, Tamilnadu, India. The plant was authenticated by Dr. G. V. S. Moorthy, Botanical survey of India, Tamil Nadu Agricultural University campus, Coimbatore. The voucher No. BSI/SC/5/23/08-09/Tech-769.

#### Preparation of plant extract

The 100 g of the powdered plant material was taken and suspended in 500 ml of 99% ethanol. The crude extract obtained was condensed using rotary evaporator to dryness [14].

### **Phytochemical screening**

Phytochemical screening was done for analyzing secondary metabolites that are responsible for curing ailments. The phytochemical screening of the plant extract was carried out by the following methods of [15,16].

### **Animals used**

The Wistar albino rats weighing between 120-140 g were obtained from Animal house of Karpagam University, Coimbatore. The animals were under standard conditions and fed with rodent diet and water *ad libitum*. The study was approved by Institutional Animal Ethical Committee (IAEC) constituted for the purpose of CPCSEA.

### **Experimental design**

The animals were divided into six groups. The animals were made obese by administration of high fat diet (2:1 ratios of ghee and animal feed). Then they were grouped into 6 groups, 6 animals in each group. The animals were identified by picric acid marking. Group I animals served as control. Group II animals induced with obesity. Group III & Group IV animals were induced with obesity and treated with plant extracts for one month. Group V & Group VI animals were given plant extracts alone for one month. At the end of the study all the rats were decapitated for collection of blood, liver and heart tissue samples to carry out biochemical assays. Serum Lipid profiles were determined by standard procedure in an auto analyzer using Abott Architect-CI 8200, Germany. Part of the liver and heart tissues used for histopathological studies. Body weight of the rats at regular interval recorded after 30 days treatment.

### **Statistical Analysis**

The values were expressed as Mean  $\pm$  SD. The statistical analysis was carried out by One-way Analysis of Variance using SPSS (version 10) statistical analysis program. Statistical significance was considered at  $p < 0.05$ .

## **Results**

The present study was carried out in order to investigate the antilipedemic and bodyweight reducing activities of ethanolic extract of both *Cissus quadrangularis* and *Tribulus terrestris* in high fat diet consumed rats. There were observable changes in the body weight of normal, *Cissus quadrangularis* and *Tribulus terrestris* treated rats. It is showed in table 1.

In Phytochemical Screening, the Ethanolic extract of *Cissus quadrangularis* showed the presence of Tannins, Phenols and Carbohydrates. *Tribulus terrestris* showed the presence of Tannins, Phenols and Saponins. Other compounds were found to be absent.

**Table 1: Body Weight of control and Experimental animals**

Body wt (g)	Group I	Group II	Group III	Group IV	Group V	Group VI
Initial	131.25± 0.13	131.40±0.08#	131.35± 0.21*	131.40 ±0.08*	131.50± 0.20 <sup>NS</sup>	131.38± 0.17 <sup>NS</sup>
15 days	147.35± 0.13	158.38±0.22#	151.21 ±0.08*	155.45 ± 0.24*	147.28 ± 0.36 <sup>NS</sup>	151.18± 4.46 <sup>NS</sup>
30 days	157.67±0.15	169.45±0.21#	160.25± 0.17*	164.25±0.17*	157.45 ± 0.24 <sup>NS</sup>	157.50± 0.17 <sup>NS</sup>

Values are Mean ± SD, n=6, #p<0.01, \*p<0.05, NS (Not Significant); # Group II compared with Group I; \*Group III and Group IV compared with Group II; NS Group V and VI compared with Group I

**Table 2: The concentration of Lipid profile in serum of control and experimental groups**

Particulars	Group I	Group II	Group III	Group IV	Group V	Group VI
Cholesterol (mg/dl)	128.50 ± 0.58	270.50 ± 1.00#	140.00± 0.82*	147.85± 0.26*	128.83± 0.23 <sup>NS</sup>	157.41±52.17 <sup>NS</sup>
TG(mg/dl)	84.28 ± 0.25	224.75 ± 0.65#	110.53± 0.46*	111.25 ±0.55*	84.20± 0.08 <sup>NS</sup>	84.25 ±0.34 <sup>NS</sup>
HDL (mg/dl)	38.00 ± 0.08	28.00±0.09#	36.10± 0.14*	35.93± 0.09*	38.00± 0.08 <sup>NS</sup>	38.00 ±0.14 <sup>NS</sup>
LDL (mg/dl)	70.07± 0.09	196.08± 0.09#	80.08± 0.09*	81.50± 0.57 *	69.75± 0.95 <sup>NS</sup>	69.95 ±0.129 <sup>NS</sup>
VLDL (mg/dl)	20.40 ± 0.08	35.38± 0.13#	21.13± 0.09*	24.20± 0.08*	20.45± 0.13 <sup>NS</sup>	20.37 ±0.09 <sup>NS</sup>
CHOL/HDL	3.38 ± 0.02	9.62± 0.06 #	3.87± 0.02*	4.11± 0.01*	3.40 ±0.05 <sup>NS</sup>	3.40 ± 0.04 <sup>NS</sup>

Values are Mean ± SD, n=6, #p<0.01, \*p<0.05, NS (Not Significant); # Group II compared with Group I; \*Group III and Group IV compared with Group II; NS Group V and VI compared with Group I

Cholesterol, Triglyceride, LDL and VLDL levels were found to be increased ( $p<0.01$ ) in (Group II) rats when compared with (Group I) rats (Table 2). These levels were found to be decreased ( $p<0.05$ ) when compared (Group III and IV) rats with (Group II) rats. The HDL levels were decreased ( $p<0.01$ ) in (Group II) rats, when compared with (Group I) rats, but it significantly increased ( $p<0.05$ ) in plant extract treated (Group III and IV) rats when compared with (Group II). It is showed in table 2.

The histopathological architecture of heart and liver of the rats treated with ethanolic extract of *C.quadrangularis* showed more are less normal pattern, with lessened fatty infiltration (Fig.1 and Fig.2).

**FIG-1 HISTOPATHOLOGY OF RAT HEART**

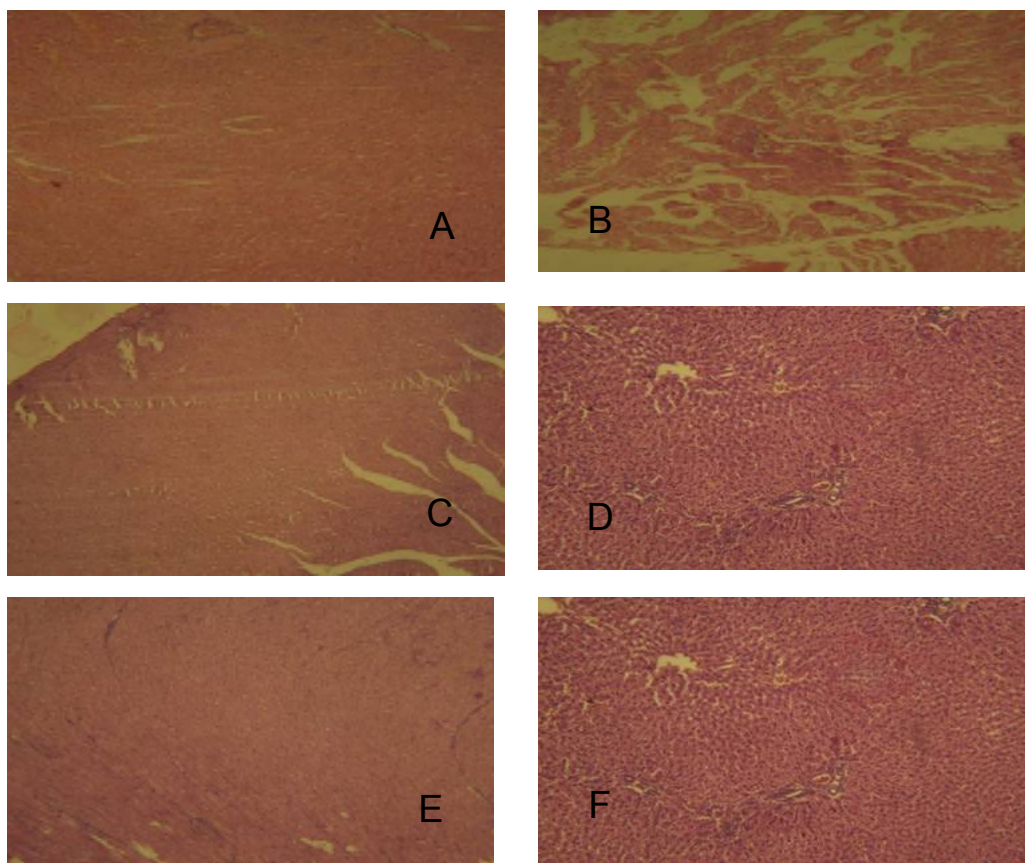
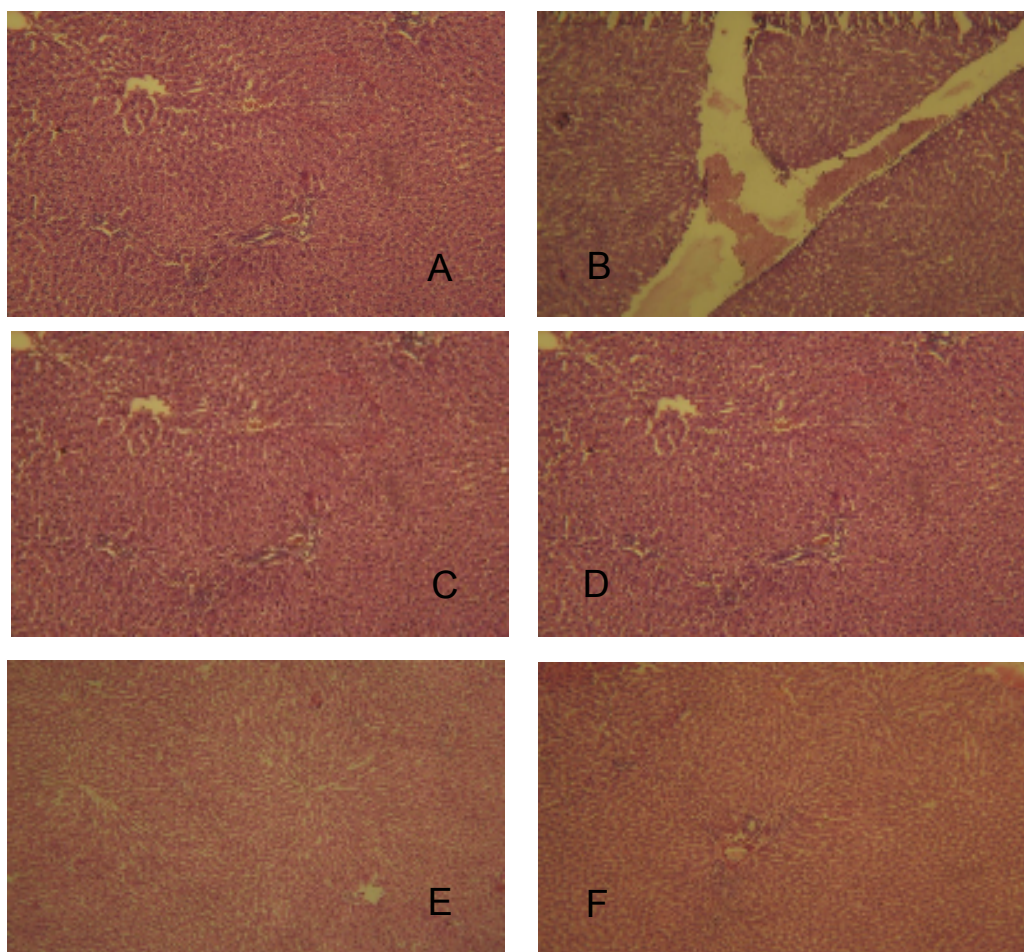


FIG-2 HISTOPATHOLOGY OF RAT LIVER



### Discussion

The present study was aimed to assess the anti-obesity effect of ethanolic extract of *Cissus quadrangularis* and *Tribulus terrestris* on high fat diet induced obesity in albino rats. Initially the body weight of all rats in all groups was in the range of 120- 140grams. After 15<sup>th</sup> day and 30<sup>th</sup> day, the high fat diet consumed (Group II) rats increased their body weight. When it was treated with these medicinal plant drugs the reduction of body weight was noted. After treatment with these plant extracts, the group treated with *Cissus quadrangularis* showed significant reduction in bodyweight. The plant extract alone treated group the body weight was more or less same as that of normal showed in (table 1). It has been reported that after the pomegranate seed oil the body weight of the rats were significantly decreased [17].

Previous studies have shown that high fat diet mice treated with *Capparis spinosa* and *Chamaemelum noble* extracts underwent a time dependent reduction in bodyweight [18]. The saponin fractions (chikusetsusaponins) of *Panax japonicas rhizomes* had a significant anti-obesity action in mice fed a high-fat diet [19].

After treatment with these plant extracts, the groups treated with *Cissus quadrangularis* showed significant reduction in cholesterol, TG, LDL, and VLDL levels than *Tribulus terrestris* treated groups. HDL level found to be significantly increased in *Cissus quadrangularis* as that of *Tribulus terrestris* treated groups. Group V and VI rats showed same lipid profile level as that of control group. Previously it was investigated that the lipid lowering effect of 50% ethanolic extract of *Aefle marmelos* (Linn) in triton and diet induced hyperlipidaemic models of Wistar albino rats [20]. In hypercholesterolemia, there are high levels of lipids and phospholipase A<sub>2</sub> and cyclooxygenase enzymes [21].

Histopathology of the heart section of control animals (Fig 1.A, Group I) showed normal cells. The high fat diet induced rats (Fig 1.B, Group II) showed myocardium with focal hemorrhage, scattered inflammatory infiltrate focal necrosis and fat infiltration. When treated with ethanolic extract of these plants the fat infiltration was lessened considerably in plant extract treated groups. Histopathological analysis of plant extract alone treated animals showed same result as that of the control group.

Histology of the liver sections of control animals (Fig 2.A Group I) showed normal hepatic cells with well preserved cytoplasm, prominent nucleus, nucleolus and visible central veins. The liver section of high fat consumed rats (Fig 2.B, Group II) showed mild periportal inflammatory infiltrate and most of the hepatocytes showing stasis, fatty changes, ballooning degeneration. When treated with plant extracts (Fig 2.C Group III and IV Fig 2.D) showed mild periportal inflammatory infiltrate. When treated with plant extract alone (Fig 2.E) the architecture of the liver was same as that of normal alone treated animals showed same result as that of the control group.

On the basis of results obtained in the present study, it can be concluded that *Cissus quadrangularis* has high antilipidemic activity than *Tribulus terrestris*.

### References

1. Caterson ID. Obesity and its Management. Australian Prescriber 1999; 22:12-6.
2. Rippe JM, Crossley S, Ringer R. Obesity as a chronic disease: Modern medical and lifestyle Management. J Am Diet Assoc 1998; 98:S9-S15.
3. Tilak-Jain JA, Devasagayam TPA. Cardioprotective and other beneficial effects of some Indian medicinal plants. J. Clin. Biochem. Nutr 2006; 38: 9-18.

4. Farvin KHS, Anandan R, Kumar SHS, Shiny KS, Mathew S, Sankar TV, Nair PGV. Cardioprotective effect of squalene on lipid profile in isoprenaline-induced myocardial infarction in rats. *J. Med. Food* 2006; 9: 531-536.
5. Packard KA, Majeed F, Mohiuddin SM, Mooss AN, Hilleman DE, Arouni AJ. Low high-density lipoprotein cholesterol is associated with impaired endothelial function in Asian Indians. *Ethn. Dis* 2005; 15: 555-561.
6. Nagle DG, Zhou YD (2006). Natural product-derived small molecule activators of hypoxia-inducible factor-1 (HIF-1). *Curr. Pharm. Res.* 12:2673-2688.
7. Chopra SS, Patel MR, Gupta LP, Datta IC. Studies on *Cissus quadrangularis* in experimental fracture repair: effect on chemical parameters in blood. *Indian J Med Res* 1975;63:824-8.
8. Chidambara Murthy KN, Vanitha A, Mahadeva Swamy M, Ravishankar GA. Antioxidant and antimicrobial activity of *Cissus quadrangularis* L.J *Med Food* 2003;6:99-105.
9. Oben J, Gyonza O. Short-term and long-term effect of Soy albumin-*Cissus quadrangularis*-green tea consumption on anthropometry, blood lipids and glucose levels in obese subjects. Master thesis, Department of Biochemistry, University of Yaoundé I 2001.
10. Oben J, Kuate D, Agbor G, Momo C, Talla X. The use of a *Cissus quadrangularis* formulation in the management of weight loss and metabolic syndrome. *Lipids Health Dis* 2006; 5:24.
11. Oben JE, Enyegue DM, Fomekong GI, Soukontoua YB, Agbor GA. The effect of *Cissus quadrangularis* (CQR-300) and a *Cissus* formulation (CORE) on obesity and obesity-induced oxidative stress. *Lipids Health Dis.* 2007; 6:4.
12. Sharp H, Hollinshead J, Bartholimew BB, Oben J, Watson A, Nash RJ. Inhibitory effects of *Cissus quadrangularis* L. derived components on lipase, amylase and  $\alpha$ -glucosidase activity *in vitro*. *National Product Communications* 2007; 2:817-22.
13. Zhang X. Traditional Medicine: its importance and protection. In: Twarog S, Kapoor P (eds). *Protecting and promoting Traditional knowledge: Systems, National Experiences and International Dimension, Part I. The Role of Traditional knowledge in Healthcare and Agriculture.* New York: United Nations 2004; 3-6.
14. Rajesh Kumar Gupta, Achyut Narayan Kesari, Geeta Watal, P.S Murthy, Ramesh Chandra, Kapil Maithal and Vibha Tandon. Hypoglycemic and antidibetic effect of aqueous extract of leaves of *Annona Squamosa* in experimental animal, *Current Science* 2005; 88:8:25.
15. Trease, G.S., and Evans, H.C.. *Text Book of Pharmacognosy*, 1978. 9<sup>th</sup> Edition. Bailiar Zindall and Co., London.
16. Harbone JB. *Phytochemical method: Chapman and Hall* 1984. London.



17. Keisuke Arao, Yu-Ming Wang, Nao Inoue, Junichi Hirata, Jae-Young Cha, Koji Nagao and Teruyoshi Yanagita. Dietary effect of *pomegranate seed oil* rich in 9cis, 11trans, 13cis conjugated linolenic acid on lipid metabolism in obese, hyperlipidemic OLETF rats. *Lipids in Health and Disease* 2004; 3:24.
18. Lemhadri.A, Eddouks M,Sulpice T and Burcelin . Anti-hyperglycaemic and Anti-obesity effect of *Capparis spinosa* and *Chamaemelum noble* Aqueous Extracts in HFD mice. *Am J. Pharm. Toxicol.*, 2007; 2:106-110.
19. Li-Kun Han, Yi-Nan Zheng, Masayuki Yoshikawa, Hiromichi Okuda and Yoshiyuki Kimura. Anti-obesity effects of chikusetsusaponins isolated from *Panax japonicus* rhizomes. *BMC Complementary and Alternative Medicine* 2005: 5:9.
20. Vijaya C, Ramachandran M, and Suresh B. Lipid lowering activity of ethanolic extract of leaves of *Aegle marmelos* (Linn.) in hyperlipidemic models of Wistar albino rats. *Ind J Exp* 2009; 47:182-185.
21. Laurence L Brunton, Goodman and Gilman's. *The Pharmacological basis of therapeutics* 2001, 10<sup>th</sup> Ed. McGraw-Hill Company.