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Original Research Article

Antihyperlipidemic potential of methanolic extract of whole plant *Chlorophytum comosum* (Thunb.) Jacques in poloxamer 407 induced hyperlipidemia in Wistar Albino rats

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ABSTRACT

Background: Hyperlipidaemia is a major risk factor for cardiovascular diseases, and natural remedies are being explored for safer therapeutic options. *Chlorophytum comosum* (Thunb.) Jacques has potential medicinal properties, but its antihyperlipidemic activity has not been thoroughly investigated. The objective was to evaluate the acute oral toxicity and antihyperlipidemic potential of the methanolic extract of *Chlorophytum comosum* (MECC) in Wistar Albino rats.
Methods: Acute oral toxicity was assessed following OECD 2001 guidelines at doses of 300 mg/kg and 2000 mg/kg. Hyperlipidaemia was induced using Poloxamer 407 (1 g/kg, i.p.). Animals were treated with MECC at low and high doses (200 and 400 mg/kg) for 21 days, while atorvastatin (10 mg/kg) was used as the standard. Body weight, lipid profile parameters (total cholesterol, triglycerides, LDL, VLDL, HDL), and liver histopathology were evaluated.
Results: MECC showed no mortality or significant adverse effects, indicating its safety. Treatment with MECC resulted in dose-dependent improvements in body weight and lipid profile parameters, comparable to those observed with atorvastatin. Histopathological analysis revealed that high-dose MECC maintained near-normal hepatic architecture, indicating hepatoprotective effects.
Conclusion: MECC is non-toxic and exhibits significant antihyperlipidemic activity, suggesting its potential as a therapeutic agent for managing hyperlipidaemia.

Keywords: Hyperlipidaemia, *Chlorophytum comosum* (Thunb.) Jacques, Lipid profile, Poloxamer 407

INTRODUCTION

Hyperlipidaemia is one of the most important risk factors involved in the development of cardiovascular disease.[1] Cholesterol is essential for good health. It circulates continuously in the blood for use by all body cells. The liver is responsible for making new cholesterol when needed and for processing cholesterol from food. The process is summarized in the following steps: the liver puts together packages containing triglycerides, cholesterol, and carrier proteins called lipoproteins and sends them out into the bloodstream and the fat is drawn off for energy or storage.

The low-density lipoproteins (LDLs) that are left continue circulating to bring needed cholesterol to the body's cells. LDLs not used by the cells may be deposited in artery walls, restricting blood flow; if arteries become clogged, a heart attack can occur.[2]

Dyslipidaemias involve clinically increased levels of cholesterol and triglycerides that may be accompanied by

decreased HDL levels.[3] Initial treatment modalities focus on diet and lifestyle modification, with the potential addition of lipid-lowering medication if necessary. It is often a lifelong disease process, but one that is typically quite manageable.[4]

The pathophysiology of hyperlipidaemia involves a complex interplay of genetic, dietary, and lifestyle factors, along with various metabolic processes such as lipid metabolism genetic factors, lifestyle and dietary factors, insulin resistance and metabolic syndrome, inflammation and atherosclerosis, hormonal influences and some secondary causes.[5,6]

An important class of drugs used for the treatment of hyperlipidaemia was HMG-CoA reductase inhibitors (statins), bile acid sequestrants, lipoprotein lipase activators (PPARα agonist: fibrates), lipolysis and triglyceride synthesis inhibitors, and sterol absorption inhibitors.[7] These possess significant serious adverse effects such as liver damage, rhabdomyolysis and renal failure, and hence pharmacological management of hyperlipidaemia remains unsatisfactory.[8] Current awareness of medicinal plants in the management of cardiovascular disease has encouraged the reaches for novel lipid-lowering pharmaceuticals.

Chlorophytum comosum is a species belonging to the genus Chlorophytum (family Asparagaceae) and was widely distributed across Africa, India, and Australia. The genus Chlorophytum comprises more than 200 species, many of which are traditionally recognised as medicinal herbs in some regions. Phytochemical investigations of the genus have revealed the presence of diverse classes of bioactive compounds, including phenolics, alkaloids, saponins, flavonoids, steroids, terpenoids, carbohydrates, proteins and tannins.[9]

Taxonomical classification

Taxonomical classification comprises - kingdom: Plantae, sub kingdom: Viridiplatane, clade: Tracheophytes (angiosperms), class: liliopside, subclass: liliidae, order: Asparagaceae, family: Asparagaceae, subfamily: Agavoideae, genus: Chlorophytum, species: *C. Comosum*, and authority: [Thunb.] Jacques.

Due to its long history of use in traditional medicine, the genus Chlorophytum has attracted considerable attention from researchers in evidence-based medicine. Preparations derived from various Chlorophytum species have been extensively investigated for their biological activities and have been reported to exhibit immunomodulatory, anti-infective, antibacterial, antinociceptive, and antioxidant properties.

In addition, these preparations have been shown to improve male sexual health and to ameliorative conditions such as diabetes, hyperglycaemia, and hyperlipidaemia, as well as toxic-induced hepatic and testicular impairments.[9,10]

The main aim of the treatment in patients with hyperlipidaemia is to reduce the risk of developing ischemic heart disease or the occurrence of further cardiovascular or cerebrovascular disease.

Figure 1: *Chlorophytum comosum*.

METHODS

In the present study male Wistar Albino rats served as an experimental animal.

Drugs and chemicals

Atorvastatin (Apollo Pharmacy, Melmaruvathur), Ketamine HCl, methanol and petroleum ether was obtained from Naresh Scientific Company, Puducherry. Poloxamer 407 (Strides Pharma Science Ltd).

Study type

The study was *in-vivo* preclinical study.

Study period

The study was conducted from July 2025 to December 2025.

Study place

The study was conducted in Animal House, Department of Pharmacology, Adhiparasakthi College of Pharmacy, Melmaruvathur.

Collection and authentication of plant material

The fresh whole part of the plant *C. comosum* (Thunb.) Jacques was collected from the wild source in and around Melmaruvathur, Chengalpattu district, Tamil Nadu, India, and it was authenticated by the scientist Dr. S. S. Hameed, Botanical Survey of India, Coimbatore, Tamil Nadu, with the specimen no: BSI/SRC/5/23/2025-26/Tech-533.

Preparation of methanolic extract

The whole plant of *C. comosum* (Thunb.) Jacques were dried at room temperature immediately after collection and subjected to milling to collect the coarse powder. About 250 g of coarse powder was defatted with petroleum ether, and again the coarse powder was subjected to extraction with methanol for 72 hours using a Soxhlet apparatus.

Preliminary phytochemical investigation

The methanolic extract of *C. comosum* (Thunb.) Jacques was investigated for the Preliminary phytochemical compounds according to the standard procedures.[11-13]

Experimental animals

In this study, male Wistar albino rats (180-200 g) were used as test animals and were obtained from Mass Biotech, Chengalpattu, Tamil Nadu, India. The rats were maintained under a temperature-controlled environment at a temperature of 25°C±20°C with a 12-hour light and 12-hour dark cycle. The rats were individually housed in polypropylene cages (18"×10"×8") lined with sterilised paddy husk and provided filtered tap water and rat food adlibitum. The study was approved by the Institutional Animal Ethical Committee (Certificate no: APCP/IAEC.2025-2026/I/03). All the experiments were carried out as per the guidelines of the Committee for the Purpose of Control and Supervision of Experiments on Animals, Government of India.

Acute oral toxicity

Acute toxic class method OECD (2001) were followed to obtain the maximum safety dose of the extract. For animal welfare reasons the starting dose to be used is 300 mg/kg body weight. Three Wistar Albino rats – single dose 300 mg/kg and 2000 mg/kg of the extract was orally administrated to overnight fasted rats. Animals will be examined individually for the first 30 min, particular focus on 4 hours, intermittently for 24 hours and further assessed for a period of 14 days. Mortality rate observed in 2 or 3 animals considered as toxic dose. Mortality of one animal or no mortality observed, same dose is repeated again for confirmation. Further higher dose was decided based on the results.[14]

Observation

The following clinical observation were made and recorded, pre- terminal deaths, body weight, cage side observation like the home cage activity, colour, and consistency of the faeces, behaviour of the animal will be observed once in two days. Physical examination observation includes skin and fur, eyes i.e., lacrimation, eye lid closure corneal reflex, lighting reflex and mucus membrane. Attention will be directed to sign of tremor, convulsion, salivation, lethargy, diarrhoea, sleep and coma noted. Tail elevation, static limb position, head position, righting reflex and pinna reflex will be monitored.

Antihyperlipidemic study of the methanolic extract

Hyperlipidaemia was induced in the animals by a single intraperitoneal injection of a freshly prepared solution of Poloxamer 407 (1000 mg/kg) in physiological saline after overnight fasting for 24 hrs. The animals were subjected to experimentation after 48 hours of hyperlipidaemia induction.

Healthy adult Wistar Albino rats (180 – 200 g) were used to evaluate the hypolipidemic activity of the methanolic extract of the whole plant of *Chlorophytum comosum* (Thunb.) Jacques (MECC). The animals were acclimatised for 7 days under standard laboratory conditions, including a controlled temperature.[15,16]

Animal grouping

The animals were divided into five groups that contain six animals per group. Group I: normal control -normal saline, orally for 21 days, group II: disease control - poloxamer 407 1 g/kg i.p single dose, group III: standard control - poloxamer 407 1 g/kg i.p. single dose+Atorvastatin 10 mg/kg orally for 21 days, group IV: treatment group - poloxamer 407 1 g/kg i.p. single dose+low dose of MECC for 21 days and group V: treatment group – poloxamer 407 1 g/kg i.p.+high dose of MECC for 21 days.

On the 21st day, animals were anaesthetised by using ketamine/xylazine anaesthesia. Blood was collected by cardiac puncture and sacrificed. The blood sample collected was centrifuged to collect the serum, which will be kept at −20°C until use for the estimation of the following 5 parameters. The liver tissues were isolated and preserved in 10% formalin for histopathological studies.

Evaluation parameters

Evaluation parameters were body weight monitoring, lipid profile (low density lipoprotein cholesterol (LDL–C), very low-density lipoprotein (VLDL), high density lipoprotein cholesterol (HDL–C), serum total cholesterol (TC), serum triglycerides (TG)) and histopathological examination of liver tissues.

RESULTS

Preparation of methanolic extract

The percentage yield of the methanolic extract of *C. comosum* (Thunb.) Jacques was 13.2±0.5% w/w.

Preliminary phytochemical investigation

The preliminary phytochemical investigation for the methanolic extract of the plant reported the presence of

carbohydrates, glycosides, flavonoids, phenols, tannins, saponins and phytosterols.

Acute oral toxicity

From the acute toxicity study, it was revealed that there were no changes in body weight, cage side observations, physical observations, morbidity and mortality up to 2000 mg/kg. So, it was selected 1/5th (high dose) and 1/10th (low dose) for *in-vivo* studies.

Evaluation of the antihyperlipidemic study of the methanolic extract

Effect of *C. comosum* (Thunb.) Jacques on body weight. The body weight of animals was recorded on day 0 and day 21 of the experimental period, and the results are presented in Table 1.

The disease control group showed a marked increase in body weight (28.8%) compared to the normal control group (4.3%). Treatment with the standard drug Atorvastatin resulted in a reduction in body weight (−2.4%). Animals treated with *C. comosum* (Thunb.) Jacques extract at 300 mg/kg showed a moderate increase in body weight (17%), whereas treatment with the high dose (400 mg/kg) produced a reduction in body weight (−3.8%).

Effect of C. comosum (Thunb.) Jacques on an antihyperlipidemic study

In the present study, carried out to evaluate the antihyperlipidemic activity of the methanolic extract of *C. comosum* (Thunb.) Jacques, induction of hyperlipidemia with Poloxamer-407 produced a significant increase in body weight along with a marked elevation in serum total cholesterol, triglycerides, LDL, and VLDL levels in the disease control group when compared with the normal control animals.

However, co-administration of Atorvastatin (10 mg/kg) and the methanolic extract of *Chlorophytum comosum* at low and high doses significantly reduced this altered lipid parameters in treated animals as compared to the disease control group. The serum HDL level was significantly reduced in the disease control group when compared to the normal group, whereas treatment with the standard drug and high-dose extract significantly increased HDL levels towards normal values.

The low-dose extract produced only a moderate improvement in lipid parameters, with no statistically significant changes observed in some biochemical parameters when compared to the disease control group (Table 2).

Table 1: Body weight changes.

S. no.	Groups	Body weight (gm)			
		Initial	Final	Difference	Weight change (%)
1	**Normal control**	120.8±2.38	126±1.87	5.2	4.3
2	**Disease control**	141.6±8.33	182.5±8.53	40.9	28.8
3	**Standard**	133.3±8.33	130±8.16	-3.3	-2.4
4	***Chlorophytum comosum* (Thunb.) Jacques extract 200 mg/kg**	107.5±4.78	125.8±5.38	18.3	17
5	***Chlorophytum comosum* (Thunb.) Jacques 400 mg/kg**	152.5±4.78	146.6±9.09	-5.9	-3.8

Table 2: Lipid profile.

Lipid profile	Animal grouping				
	Normal control	Disease control	Standard	Low dose (200 mg/kg)	High dose (400 mg/kg)
Total cholesterol (mg/dl)	61.83±0.94	73.5±1.56	54.16±0.30	50.66±0.33	64±0.25
Triglycerides (mg/dl)	40±0.25	50.66±0.33	16±0.25	17.5±0.34	17.33±0.33
Low-density lipoprotein (mg/dl)	26.66±0.71	28±0.96	26.38±0.16	20.26±0.06	28.3±0.10
High-density lipoprotein (mg/dl)	27.66±0.21	31.5±0.34	23.8±0.30	0.44±0.21	31.83±0.30
Very low-density lipoprotein (mg/dl)	7.5±0.34	49.66±0.42	3.2±0.05	3.58±0.03	3.6±0.04

Analysed by one-way analysis of variance (ANOVA) followed by multiple comparison Dunnet 't' test. All the values are expressed as mean±SEM (n=6)

Histopathological assessment of the liver sections processed and stained using the standard haematoxylin and eosin (H and E) technique and the result was illustrated.

Histopathological studies of liver

Photomicrographs show longitudinal sections of normal histomorphology of adult female Wistar Albino rat liver. Black arrows, black pointed arrows, black star and black triangle indicate normal hepatocytes, sinusoidal spaces, central vein and portal triad respectively (Figure 2a and b).

Figure 3a reveals severe diffuse hydropic degeneration (green pointed arrows) with absence of sinusoidal spaces whereas Figure 3b shows moderate focal periportal inflammation (green star) with marked cellular swelling (green arrows).

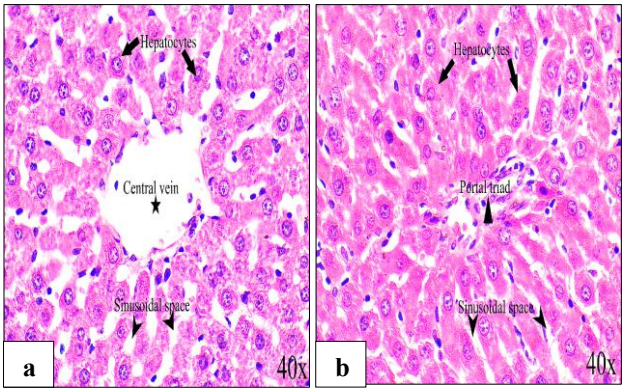

Figure 2 (a and b): Photomicrograph of rat liver-normal control group.

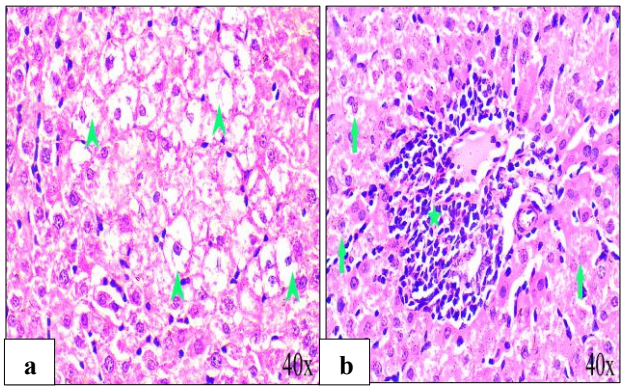

Figure 3 (a and b): Photomicrograph of rat liver - disease control group.

Figure 4a and b shows majority of normal liver parenchyma compared to the negative control group except mild cellular swelling (green arrow) and mild periportal inflammation (green star).

Figure 5a and b shows moderate diffuse cellular swellings (green arrows) and mild periportal inflammation (green star).

Figure 6a and b reveals normal structure and cellular morphology of liver parenchyma compared to the negative control group with minimal cellular swelling (green arrow).

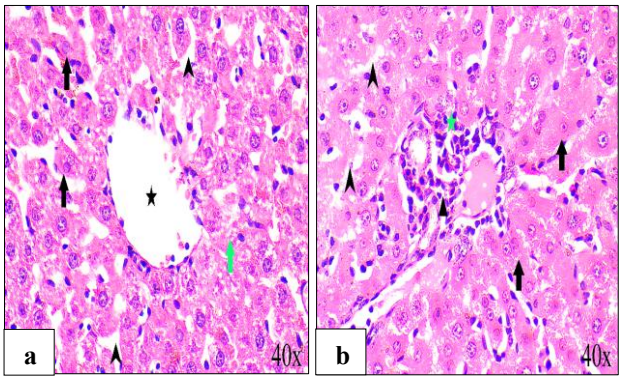

Figure 4 (a and b): Photomicrograph of rat liver-standard control group.

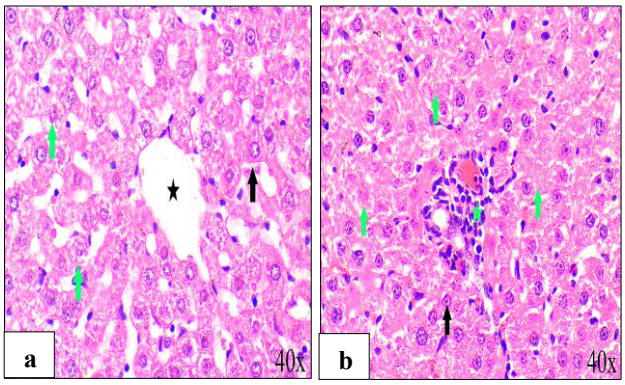

Figure 5 (a and b): Photomicrograph of rat liver-low dose group.

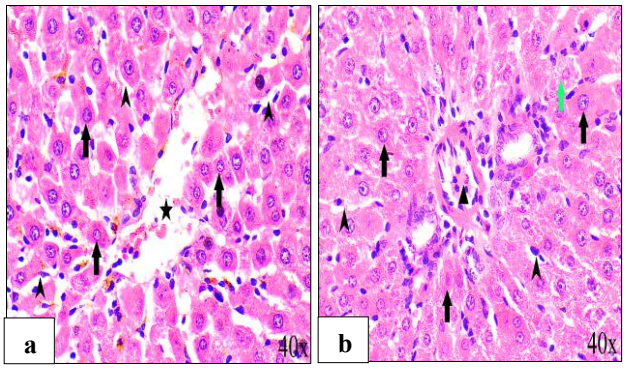

Figure 6 (a and b): Photomicrograph of rat liver-high dose group.

DISCUSSION

Hyperlipidaemia is a major metabolic disorder closely associated with cardiovascular diseases, and experimental models using Poloxamer-407 are well established for inducing acute hyperlipidaemia through inhibition of

lipoprotein lipase and increased hepatic lipid synthesis.[6] In the present study, the antihyperlipidemic potential of the methanolic extract of *C. comosum* (Thunb.) Jacques (MECC) was evaluated using Poloxamer-407–induced hyperlipidaemic Wistar Albino rats, along with an assessment of its acute oral toxicity.

The acute oral toxicity study conducted according to OECD (2001) guidelines demonstrated that MECC was safe up to 2000 mg/kg, as no mortality or treatment-related adverse effects were observed during the 14-day observation period. The absence of toxicological signs such as tremors, convulsions, salivation, diarrhoea, and behavioural abnormalities confirms the wide safety margin of the extract. These findings support the suitability of MECC for repeated oral administration in pharmacological studies.

Poloxamer-407 administration resulted in a significant increase in body weight and marked alterations in lipid parameters, confirming successful induction of hyperlipidemia. The disease control group exhibited a pronounced increase in body weight, which may be attributed to excessive lipid accumulation and altered lipid metabolism. Treatment with MECC significantly controlled body-weight gain in a dose-dependent manner, comparable to the standard drug atorvastatin. This effect suggests an improvement in lipid utilisation and metabolic regulation following extract administrations.

A significant elevation in serum total cholesterol, triglycerides, LDL, and VLDL levels was observed in the disease control group, indicating severe dyslipidaemia. Treatment with MECC at both low and high doses produced a significant reduction in these lipid parameters. The high-dose group showed a more pronounced antihyperlipidemic effect, approaching that of the standard drug. The reduction in LDL and VLDL is particularly important, as these lipoproteins play a key role in atherogenesis and cardiovascular risk.

HDL cholesterol levels, which are protective against cardiovascular disease, were adversely affected in hyperlipidaemic rats. Treatment with MECC significantly improved HDL levels, especially at the higher dose, indicating a beneficial modulation of lipid transport and reverse cholesterol transport mechanisms. The overall lipid-lowering effect of MECC suggests its ability to normalise disturbed lipid metabolism induced by Poloxamer-407.

Histopathological examination of liver tissues further substantiated the biochemical findings. The disease control group showed severe hydropic degeneration, hepatocellular swelling, and periportal inflammation, indicating hepatic damage due to lipid overload. In contrast, MECC-treated groups exhibited dose-dependent protection against hepatic injury.

The high-dose group showed near-normal hepatic architecture with minimal cellular swelling, comparable to the standard drug group. This hepatoprotective effect may be attributed to the antioxidant and lipid-regulating phytoconstituents present in *C. comosum*.

Collectively, the biochemical, body-weight, and histopathological findings indicate that MECC possesses significant antihyperlipidemic activity with a favourable safety profile. The observed effects may be mediated through modulation of lipid metabolism, inhibition of lipid synthesis, enhancement of lipid clearance, and protection against hepatic damage.[14-16]

CONCLUSION

The present study demonstrates that the methanolic extract of *C. comosum* (Thunb.) Jacques is safe and non-toxic up to a dose of 2000 mg/kg and exhibits significant antihyperlipidemic activity in Poloxamer-407–induced hyperlipidaemic Wistar albino rats. MECC effectively reduced serum total cholesterol, triglycerides, LDL, and VLDL levels while improving HDL cholesterol in a dose-dependent manner. The extract also prevented excessive body-weight gain and protected hepatic tissue from hyperlipidaemia - induced pathological alterations.

Among the tested doses, the high dose of MECC showed superior efficacy, comparable to the standard drug atorvastatin. These findings support the potential of *C. comosum* as a promising natural antihyperlipidemic agent. Further studies focusing on the isolation of active phytoconstituents and elucidation of the precise molecular mechanisms are warranted to validate its therapeutic potential.

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