

# Assessment of Anti-Hyperlipidemic Property From The Flower Extracts of Capparis Decidua in Experimental Animals Using Diet Induce Hyperlipidemic Model

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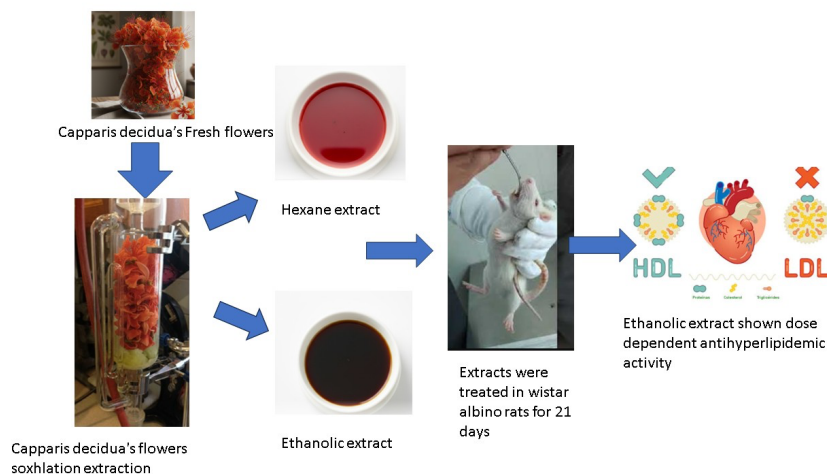
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## Graphical abstract



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### Abstract:

Hyperlipidemia is a growing health challenge in the world especially in developing nations such as India. This paper is to highlight the research work towards antihyperlipidemic properties of hexane and ethanol floral extracts of *Capparis decidua* on high-fat diet-induced hyperlipidemic Wistar albino rats. The preliminary qualitative phytochemical analysis revealed that the ethanolic extract contains high levels of flavonoids and phenolic compounds, whereas the hexane extract is composed primarily of oils and steroids. As per the experimental work after 21 days of the drug treatment and mean body weight was measured at every 5 days of drugs treatment based on the results of blood testing the ethanolic floral extract of *Capparis decidua*, particularly at high dose, significantly improved lipid profiles by reducing total cholesterol, triglycerides, LDL, and VLDL, and by increasing HDL levels, similar to Atorvastatin which is considered to be standard drug. Conversely, the hexane extract has not shown significant effects like the ethanolic extract. These findings suggest the potential use of *Capparis decidua* flowers in the natural management of hyperlipidemia.

**Keywords:** Antihyperlipidemia, Total cholesterol, Low density lipoproteins, High density lipoproteins.

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### Introduction:

Hyperlipidemia is a disease of the metabolism, which is manifested by increased plasma lipid levels and includes total cholesterol, triglyceride, Low-density lipoprotein cholesterol (LDL-C), very low-density lipoprotein cholesterol (VLDL-C), and a decrease in high-density lipoprotein cholesterol[1]. This lipid homeostasis disturbance makes one highly prone to atherosclerosis, coronary heart disease, stroke, and other cardiovascular issues, which are Leading causes of illness and mortality in the world. The abnormal accumulation of lipids in the bloodstream hastens the formation of vascular plaque, resulting in compromised blood flow in the arteries and a heightened risk of acute cardiac incidents[2]. The trend of hyperlipidemia is growing at an alarming pace in the world due to sedentary living, unhealthy dietary habits that are rich in saturated fats and refined carbohydrates, obesity, and lack of physical exercise [3]. According to estimations by the World Health Organisation, cardiovascular diseases that are a result of dyslipidemia cause a significant mortality burden in the world today, and estimates show that it will continue to increase in the next few decades. Hyperlipidemia and associated dyslipidemias have become a major social health issue in India[4]. Several epidemiological studies show that lipid abnormalities are very common in Indian adults and that there is a significant tendency of atherogenic dyslipidemia (high triglyceride levels, low HDL-C, high LDL-C) that is contributing to the increasing burden of cardiovascular disease in this nation. The age of onset of dyslipidemia is lower in Indians than in the Western population, and it is a condition that is predetermined by genetic factors and diet as well as

lifestyle. Moreover, the level of awareness, treatment, and control of dyslipidemia in India is still not the best, and a lot of people are still not aware of their lipid levels[5]. They are not managed properly due to economic constraints and difficulties accessing healthcare.

The allopathic treatment of hyperlipidemia is currently mostly based on lipid-lowering drugs, including statins, fibrates and niacin[6]. There are, however, often negative effects of their long-term use, such as myalgia, increased liver enzymes, increased risk of new-onset diabetes and infrequent but severe muscle-toxicity including rhabdomyolysis[7]. These adverse effects, along with patient nonadherence and the cost of chronic treatment, indicate the limitations of current treatment methods.

Consequently, natural and plant-based agents for lipid management are attracting increasing interest[8]. The use of medicinal plants across cultures takes been a extended tradition for balancing lipid profiles and promoting cardiovascular health, with minimal side effects compared to conventional drugs. Several phytochemicals, such as flavonoids, saponins, and phytosterols, have shown lipid-lowering effects by inhibiting cholesterol synthesis, increasing bile acid secretion, or improving antioxidant status[9]. Although there exist encouraging early data, there is a relative lack of good preclinical trials to determine the effectiveness, mechanisms and dose response relations of herbal extracts in hyperlipidemic models - especially of many native medicinal plants.

*Capparis decidua* is an Indian herb reported to have antioxidant and metabolic regulatory properties[10]. Nevertheless, there are few systematic studies on its

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antihyperlipidemic properties, particularly with the well-standardised extraction procedures and models[11]. The lack of systematic evidence also underscores the importance of conducting rigorous pharmacological research on *C. Decidua* extracts to support their potential for pharmacological and safety benefits[12].

The current learning sought to measure the antihyperlipidemic properties of the ethanolic extract of *Capparis decidua* fashionable a hyperlipidemic model caused by a high-fat diet Wistar albino rats, thereby offering evidence for the product's potential as a safe, effective, and natural alternative for lipid regulation.

### Methodology:

The flowering tops of *Capparis decidua* has been procured nearby Gwalior and authenticated by the Botanist “Prof D Ramakanth Raju”. A sample copy (G.S.R./S.G-001) of the plant material was deposited in the pharmacognosy lab at the School of Pharmacy, ITM University, Gwalior.

### Processing of Floral extraction:

Obtained flowers has been shade dried there by subsequently grounded into coarse powder by passing through a #20 sieve, followed by Soxhlet extraction with solvents including hexane and ethanol for 72 hours[13]. Solvents were removed using a rotary evaporator to produce solvent-free extracts, which were stored in a vacuum dessicator. It was discovered that the yields were 5% and 42%, respectively. Pretrial phytochemical screening of the obtained extracts was performed. Oral extracts were formulated at concentrations of 250 and 500 milligrams per milliliter utilizing a 5% aqueous solution of gum acacia [14].

### Preliminary phytochemical testing:

Obtained plant extracts were subjected to preliminary phytochemical screening to various series of tests, and the results were represented in Table:1

### Toxicity screening of the extracts:

Toxicity assessments were performed on adult Swiss albino mice of 20 to 25 g. The mice categorized into control and experimental sets, each consisting of six individuals[15]. The trial will employ a control group receiving 5% Saline then a test group of mice were administered graduated doses of extracts. The rats observed meticulously from 4 hours and then till 48 hours prior to slightly behavioral alterations, then morbidity as well as lethality were assessed.

### Antihyperlipidemic activity screening[16]:

Healthy Wistar albino rats, weighing 150-200 g, were examined under controlled settings with a standardized diet

and unrestricted access to water [17]. They were split into five groups: Normal control, Toxic control, Standard treatment (Atorvastatin 10 mg/kg), Test Group I (C.D.H.E), and Test Group II (C.D.E.E). The latter two groups got 100 mg/kg of plant extracts. For 20 days, all save the normal group were given a diet high in cholesterol to cause hyperlipidemia. We kept track of the animals' body weights, and on day 21, we looked at blood samples to see how their lipid profiles were doing. This included Total Cholesterol (TC), Triglycerides (TG), HDL, VLDL, and LDL. The values were represented in Table:2 and Table:3

### Statistical analysis:

All experimental results are presented as mean ± Standard Error of the Mean (S.E.M). A statistical assessment was conducted utilizing one-way Analysis of Variance (ANOVA) succeeded by Dunnett's multiple comparison test [18]to compare the treatment groups with the corresponding control group. Statistical significance was established at a p-value below 0.05 ( $p < 0.05$ ). Values with  $p \geq 0.05$  were considered statistically non-significant (ns).

**Table:1: Reports of preliminary phytochemical screening of *Capparis deciduas* extracts**

Phytochemical Test	<i>C. decidua</i> Hexane extract	<i>C. decidua</i> Ethanolic extract
Alkaloids	-ve	+Ve
Flavonoids	-ve	+ve
Tannins	-ve	+ve
Saponins	-ve	+ve
Phenolic Compounds	-ve	+ve
Terpenoids	+ve	+ve
Steroids	+ve	+ve
Glycosides	-ve	+ve
Carbohydrates	-ve	+ve
Proteins & Amino acids	-ve	+ve

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<b>Fixed Oils &amp; Fats</b>	+ve	-ve
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+ve= Presence of the compound    -ve= Absence of the compound

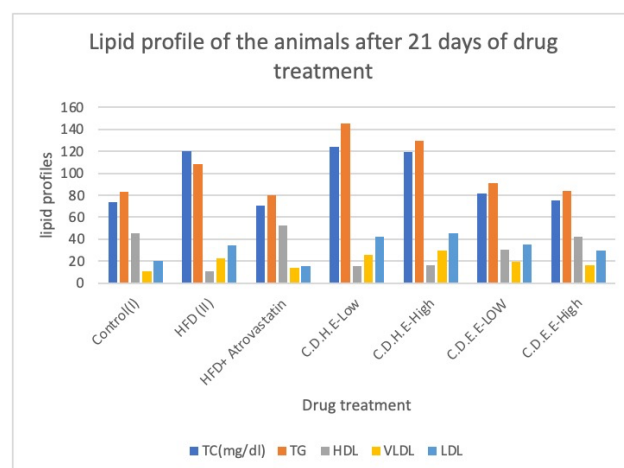
**Table: 2 Body weight assessment in the groups of animals selected for the testing during 21 days of treatment**

Gro ups	Drugs treated	0 <sup>th</sup> Day	5 <sup>th</sup> Day	10 <sup>th</sup> Day	15 <sup>th</sup> Day	20 <sup>th</sup> Day
I	Control	152±0.02	152±0.03	154±0.02	154±0.01	155±0.02
II	HFD +Vehic le	151±0.01	176±0.02	193±0.02	215±0.01	264±0.05
III	HFD +Atrov astatin	152±0.03	153±0.04	153±0.02	155±0.03	156±0.01
IV	C.D.H. E-LOW	154±0.03	195±0.05	210±0.05	239±0.04	265±0.05
V	C.D.H. E-HIGH	153±0.01	179±0.03	182±0.04	236±0.6	281±0.4
VI	C.D.E. E-LOW	152±0.02	159±0.01	161±0.02	169±0.03	172±0.03
VII	C.D.E. E-High dose	153±0.04	156±0.03	158±0.02	161±0.01	163±0.02

**Table:3 Lipid profile parameters observed in various Test group animals**

Grou ps	TC(mg /dl)	TG	HDL	VLDL	LDL
Contr ol(I)	73.89±0.05	82.89±0.02	45.14±0.03	10.77±0.03	20.01±0.02
HFD (II)	120.19±0.04*	108.29±0.03*	11.07±0.02**	22.31±0.01**	34.02±0.04**
HFD + Atrov astati n	70.23±0.01	80.33±0.14	52.14±0.05	14.32±0.03	15.31±0.02

C.D. H.E-Low	124.21±0.01	145.24±0.02	15.31±0.03	26.12±0.02	42.31±0.02
C.D. H.E-High	119.34±0.02	129.34±0.3	16.21±0.01	29.31±0.01	45.31±0.06
C.D. E.E-LOW	81.25±0.1*	91.22±0.02*	30.14±0.02*	19.21±0.05*	35.12±0.02*
C.D. E.E-High	75.12±0.02**	84.11±0.01**	42.12±0.04*	16.31±0.01*	29.32±0.05*



**Graph:1 Representation of lipid profile of various drug treatment by using Bar graph**

**Discussion :**

Initial phytochemical screening of *Capparis decidua* extracts showed a considerable disparity: the hexane extract contained fixed oils, fats, terpenoids, and steroids, but lacked polar bioactive compounds, which have a weaker antihyperlipidemic effect[19]. Conversely, the ethanolic extract contained a high concentration of flavonoids, phenols, alkaloids, tannins, saponins, glycosides, and carbohydrates, suggesting that polar compounds were more readily extracted [20]. Flavonoids and phenolics are linked to the lipid-lowering and heart-protective effects, and saponins decrease the absorption of cholesterol in the gut. Terpenoids and steroids were also found in the two extracts, although their actions were insignificant, and there were no significant antioxidant and hypolipidemic compounds [20]. These findings are in agreement with the pharmacological results, that put emphasis on the high antihyperlipidemic activity of ethanolic extract and utility of ethanol in the extraction of

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bioactive compounds[21].

Diet-induced hyperlipidemic models are linked to body weight monitoring that is necessary because of metabolic issues[22]. It has been found to have a significant difference in the mass of the between various groups in this study. Group I, the control group who were normal indicated constant weight gain, which is an indicator of metabolic stability. Contrarily, the control group (Group II) consisting of high-fat diet (HFD) demonstrated vigorous weight gain according to diet-induced obesity. The condition of atorvastatin (Group III) did not change the body weight relative to the controls and this means that it does not lead to excess fat. The hexane extract of *Capparis decidua* (Groups IV and V) too displayed pronounced weight gains and this implies that it cannot be used against gain caused by HFD due to its phytochemical composition. On the other hand, the ethanolic extract (Group VI and VII) exhibited a dose-dependent protection because high doses decreased weight gain, probably because of the bioactive compounds increase lipid metabolism and energy consumption. Overall, the ethanolic extract of *Capparis decidua* may be one of potential therapeutic agents in the case of hyperlipidemia and metabolic disorders because it inhibits weight gain on a high-fat diet.

This study evaluated the antihyperlipidemic efficacy of *Capparis decidua* extracts in hyperlipidemic Wistar albino rats exposed to a high-fat diet. The control group (HFD) exhibited elevated total cholesterol (TC), triglycerides (TG), VLDL-cholesterol, and LDL-cholesterol, alongside a reduction in HDL-cholesterol, so validating the onset of hyperlipidemia. Atorvastatin normalized lipid parameters, validating the experimental model. The hexane extract of *Capparis decidua* did not improve lipid profiles because it did not have the major compounds that modify lipids in its phytochemical composition. In contrast, the ethanolic extract reduced TC, TG, LDL-C, and VLDL-C in a dose-dependent manner, with a significant increase in HDL-C, indicating a strong antihyperlipidemic effect. The bioactive phytoconstituents have been associated with the lipid-lowering effect of the ethanolic extract, underscoring the importance of solvent selection in extracting active compounds[23]. Overall, the ethanolic extract, especially with high doses, is very antihyperlipidemic, and the hexane extract is not.

### Conclusion:

This experiment revealed that a Cholesterol rich diet induced hyperlipidemia in Wistar albino rats that is characterized by high body weight and change in lipid

profiles. The protective effect of therapy with *Capparis decidua* (C.D.E.E) using their ethanolic extract was dose dependent resulting in a significant weight gain reduction and serum lipid parameter improvements over atorvastatin. The hexane extract (C.D.H.E). however, did not show any positive reaction and was rather counterproductive of lipid profiles. The active constituents of the ethanolic extract are flavonoids, phenolic compounds, and other compounds that render the extract to be effective. This paper agrees with How it has been used in the past in managing metabolic disorders and recommends that *Capparis decidua* would provide an option of behavioral replacement of traditional medicines. Nevertheless, additional studies are required to know how it works and its consequences in the long-term in the human body. The research is covering a considerable gap in the literature and is relevant to fulfill the increasing need in utilizing plant-based interventions, which are cheap and less harmful to the organism and control hyperlipidemia and cardiovascular risks.

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**Conflicts of Interest:** Authors declare no Conflicts of interest

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