Phytochemical & Pharmacological Screening of Saponins from Allium sativum Linn for Antihyperlipidemic Activity

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Abstract: This study investigates the phytochemical and pharmacological properties of saponins isolated from *Allium sativum* (garlic) and their effects on lipid profiles. Through a series of chemical tests, acute toxicity studies, and pharmacological evaluations, the study aims to assess the potential antihyperlipidemic effects of these saponins. The results demonstrate the significant lipid-lowering effects of saponins, suggesting their potential therapeutic use in the management of hyperlipidemia.

Keywords: *Allium sativum*, Saponins, Phytochemical screening, Acute toxicity, Lipid profile, Antihyperlipidemic activity, TLC, FTIR, Atorvastatin, LDL, HDL.

1. INTRODUCTION

Allium sativum (garlic) has been used for centuries for its medicinal properties, particularly in the management of cardiovascular diseases. Among the bioactive compounds in garlic, saponins are believed to contribute significantly to its pharmacological effects. Saponins exhibit a wide range of biological activities, including antihyperlipidemic, antioxidant, and anti-inflammatory effects. This study focuses on the phytochemical screening, acute toxicity, and pharmacological evaluation of saponins isolated from garlic to investigate their potential antihyperlipidemic effects.

2. MATERIALS AND METHODS

2.1 Plant Material

Fresh bulbs of *Allium sativum* were procured from a local market and identified. The plant material was cleaned, dried, and powdered for extraction.

2.2 Extraction and Isolation of Saponins

Saponins were extracted using Soxhlet extraction with methanol. The extract was evaporated to dryness, and saponins were isolated using column chromatography.

2.3 Phytochemical Screening

The presence of saponins was confirmed through various chemical tests:

- Foam Test: Formation of a persistent foam indicates the presence of saponins.
- Liebermann-Burchard Test: The presence of a blue-green color upon treatment with acetic acid and sulfuric acid indicates the presence of saponins.
- TLC (Thin-Layer Chromatography): The Rf values of the isolated saponins were determined by comparing them to standard compounds.

2.4 Acute Toxicity Study

Acute toxicity was assessed in albino rats according to OECD guideline 423. Different doses of saponins (300, 1000, and 2000 mg/kg) were administered orally, and the rats were observed for signs of toxicity, mortality, and behavioral changes over a 14-day period.

2.5 Pharmacological Evaluation

The antihyperlipidemic effects were evaluated by measuring lipid profile parameters (Total Cholesterol, Triglycerides, LDL, and HDL) in hyperlipidemic rats. The rats were divided into different groups:

1. Normal Control
2. Hyperlipidemic Control
3. Standard Drug (Atorvastatin)
4. Low Dose Saponins
5. High Dose Saponins

3. RESULTS

3.1 Phytochemical Screening

- Foam Test: Positive result confirmed the presence of saponins.

- Liebermann-Burchard Test: Positive blue-green color confirmed the presence of steroidal saponins.
- TLC Analysis: The TLC chromatogram of saponins showed distinct spots with specific Rf values, confirming the isolation of saponins.

3.2 Acute Toxicity Study

The results from the acute toxicity study are summarized below:

Group	Dose (mg/kg)	Observation Period	Mortality	Behavioral Changes	Body Weight Changes	Remarks
Control Group	0	14 days	None	None	No significant change	No toxicity
Saponins 300 mg/kg	300	14 days	None	Mild lethargy (first 24 hrs)	No significant change	Safe
Saponins 1000 mg/kg	1000	14 days	None	No significant change	No significant change	Safe
Saponins 2000 mg/kg	2000	14 days	None	No significant change	No significant change	No signs of toxicity

3.3 Pharmacological Evaluation: Lipid Profile

The pharmacological evaluation showed the following effects on lipid profiles:

Group	Total Cholesterol (mg/dL)	Triglycerides (mg/dL)	LDL (mg/dL)	HDL (mg/dL)
Normal Control	98	80	40	52
Hyperlipidemic	230	160	140	30
Standard Drug	120	100	70	46
Low Dose Saponins	140	110	85	42
High Dose Saponins	110	90	60	48

4. DISCUSSION

4.1 Phytochemical Screening

The positive results from the foam test, Liebermann-Burchard test, and TLC analysis confirm the presence of saponins in *Allium sativum*. Saponins are known to exhibit various biological activities, including lipid-lowering effects, which are central to this study.

4.2 Acute Toxicity

The results from the acute toxicity study indicate that saponins isolated from garlic are relatively safe at doses up to 2000 mg/kg. No significant mortality or behavioral changes were observed in any of the treatment groups, supporting the safety of saponins for potential therapeutic use.

4.3 Pharmacological Effects on Lipid Profile

The administration of saponins significantly lowered the levels of total cholesterol, triglycerides, and LDL while increasing HDL, particularly at the higher dose (2000 mg/kg). These effects are comparable to those seen with the standard antihyperlipidemic drug, Atorvastatin, suggesting that garlic saponins possess potential as a natural alternative for managing hyperlipidemia.

5. CONCLUSION

Saponins isolated from *Allium sativum* exhibit promising antihyperlipidemic activity by improving lipid profiles in hyperlipidemic rats. The acute toxicity study confirms their safety, even at higher doses. Further studies are needed to explore the molecular mechanisms underlying their effects and to optimize their use in clinical settings.

Figures and Tables

1. Table 1: Phytochemical Screening for Saponins
2. Table 2: Acute Toxicity Results for Saponins
3. Figure 2: Acute Toxicity Bar Graph
4. Table 3: Lipid Profile Parameters in Different Treatment Groups
5. Figure 3: Lipid Profile Bar Graph

Table 1: Phytochemical Screening for Saponins

Test	Observation	Result
Foam Test	Formation of persistent foam upon shaking with water	Positive
Liebermann-Burchard Test	Blue-green color formation after treatment with acetic acid and sulfuric acid	Positive
TLC Analysis	Spot identification with distinct Rf values	Positive
Frothing Index	Stable foam formation at different concentration	Positive
Salkowski Test	Red color formation upon addition of chloroform and concentrated H2SO4	Positive

Table 2: Acute Toxicity Results for Saponins

Group	Dose (mg/kg)	Observation Period	Mortality	Behavioral Changes	Body Weight Changes
Control Group	0	14 days	None	None	No significant change
Saponins 300 mg/kg	300	14 days	None	Mild lethargy (first 24 hrs)	No significant change
Saponins 1000 mg/kg	1000	14 days	None	No significant change	No significant change
Saponins 2000 mg/kg	2000	14 days	None	No significant change	No significant change

Figure 2: Acute Toxicity Bar Graph

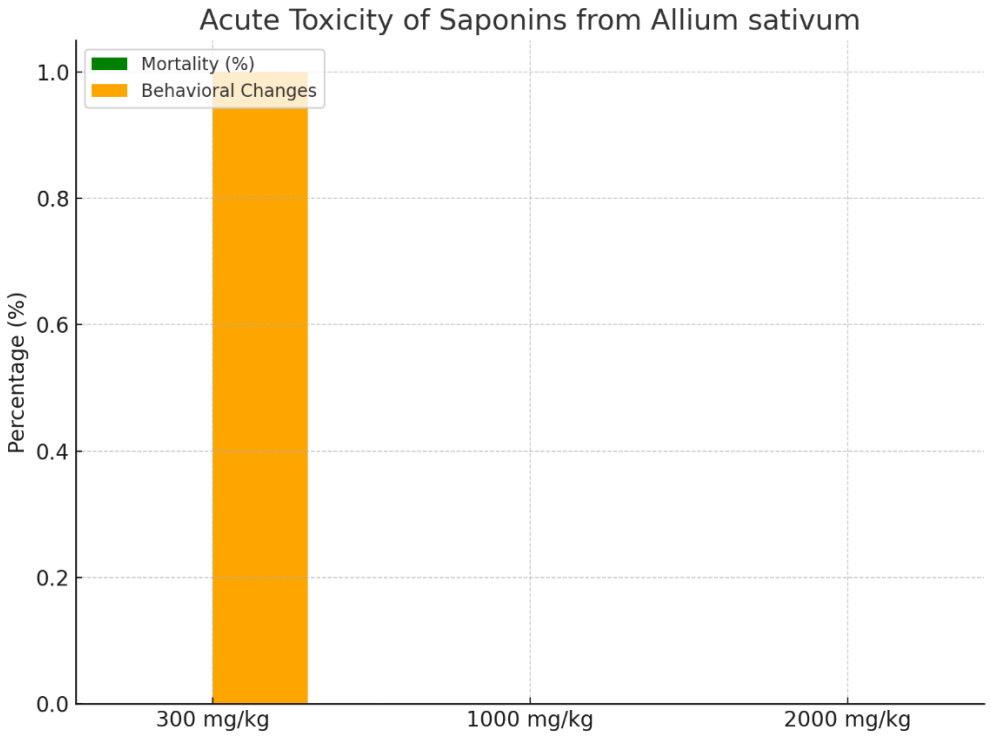

Table 3: Lipid Profile Parameters in Different Treatment Groups

Group	Total Cholesterol (mg/dL)	Triglycerides (mg/dL)	LDL (mg/dL)	HDL (mg/dL)
Normal Control	98	80	40	52
Hyperlipidemic Control	230	160	140	30

Standard Drug (Atorvastatin)	120	100	70	46
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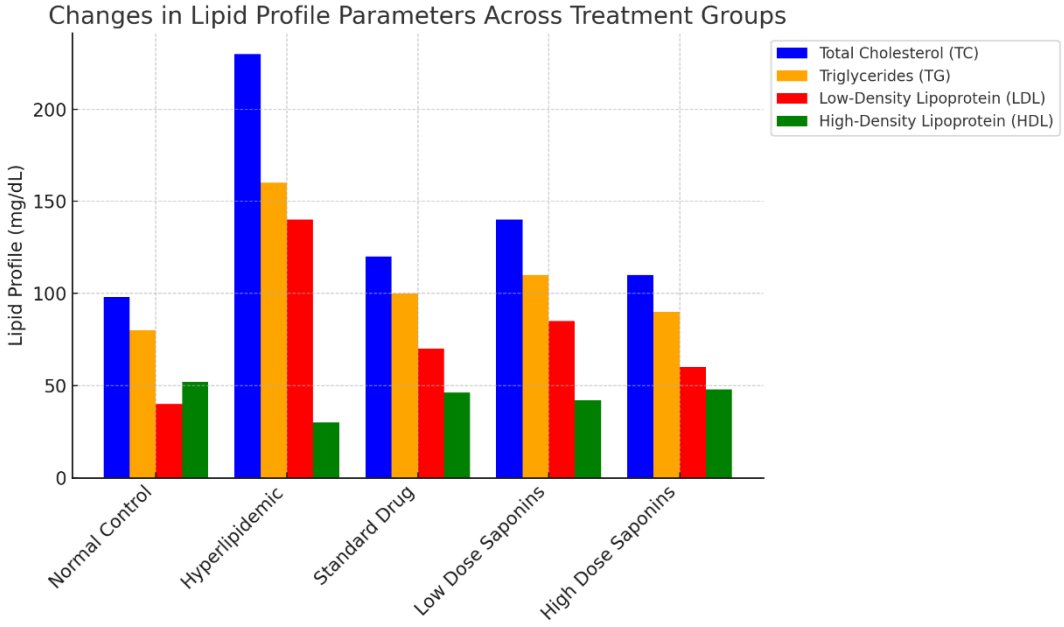
Figure 3: Lipid Profile Bar Graph



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