Original Research Article

An Evaluation of Anti-hyperlipidemic Activity of Ethanolic extract of *Mimosa pudica* on High Fat Induced Hyperlipidemic Rat Model

Comment [N1]: Why extract. Why not pure compound

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Abstract

Traditional herbal medicine (THM) is a centuries-old scientific discipline that draws its inspiration from natural sources. Throughout millennia, it has assisted humanity in combating illnesses and safeguarding vitality, well-being, and procreation. This study examined the effect of a Mimosa pudica extract on lipid profiles in rats with hyperlipidemia caused by a high-fat diet. Regarding the liver function test, Group 6, which received a large amount of fat at a rate of 900 mg/kg, showed statistically significant results ($p< 0.05$) in terms of SGPT levels. The renal function test findings indicated that group 6, which was administered dosages of 900 mg/kg, displayed significantly increased levels of urea ($p< 0.05$). The study of creatinine in groups 4, 5, and 6 yielded statistically significant findings ($p< 0.05$) for dosages of 300, 600, and 900 mg/kg, respectively. Groups 5 and 6 showed statistically significant findings ($p<0.05$) in relation to HDL and LDL. Groups 5 and 6 showed statistically significant results when given doses of 600 and 900 mg/kg, respectively. A significant statistical disparity ($p< 0.05$) was seen in the triglyceride levels between groups 5 and 6. The total cholesterol levels in Group 6, which was administered a dosage of 900 mg/kg, exhibited statistically significant findings ($p< 0.05$).

Comment [N3]: Write name of plant by using scientific method

Comment [N4]: Insufficient methodology.

Comment [N5]: Mention name as per scientific language

Comment [N6]: What is this. Don't use abbriviations in abstract

Comment [N7]: Only one parameters is not sufficient to support complete liver function test.

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Keywords: Herbal medicine, ***Mimosa pudica***, HDL, LDL, Phytochemicals.

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Introduction

The liver, the largest glandular organ, controls the majority of an individual's physiological activities. The liver receives the entire volume of an individual's blood multiple times throughout the day. It has a vital function in human metabolism [1, 2]. Excessive alcohol use, drug addiction, exposure to certain toxic compounds, or infection by viruses or parasites can induce an elevation in reactive oxygen species (ROS) activity, such as OH, H_2O_2, and O_2, which can lead

to cellular damage in the liver [3]. The Centres for Disease Control and Prevention surveyed 1492 clinicians providing ambulatory treatment in non-government facilities, and found that hyperlipidemia ranks second only to hypertension among the top ten chronic conditions they see [4]. According to the research that has been conducted, the primary reason for hyperlipidemia is the excessive consumption of foods that are rich in fat [5].

The liver undergoes extensive metabolism of the most commonly used anti-hyperlipidemic drugs, such as Atorvastatin, Pravastatin, Fluvastatin, Simvastatin, Lovastatin, and Rosuvastatin, which results in very low bioavailability [6].

Statins function as reversible competitive inhibitors of the enzyme 3-hydroxy-3-methylglutaryl-co-A reductase (HMG-CoAR). By doing so, they reduce the production of cholesterol within cells. The ability of statins to penetrate the hepatocyte and inhibit HMG-CoAR dictates their pharmacological response [7]. Muscle problems, also known as statin-associated muscle symptoms (SAMS), are the most common side effect that limits the use of statins. Other side effects include diabetic mellitus (DM) and problems with the central nervous system [8]. In addition to the severe adverse effects, these artificial medications are expensive, and the patient may face financial challenges if they complete the whole course of treatment [9]. Therefore, it is essential to develop powerful antihyperlipidemic medications that have minimal negative side effects. Plants are crucial in the process of discovering and synthesising novel drugs. They are a valuable and plentiful source of naturally occurring therapeutic chemicals [10].

Experts in the field suggest that some chemical constituents obtained from medicinal plants have therapeutic properties. Consequently, researchers are always searching for novel herbal remedies and other plant-derived treatments to address a diverse array of diseases [4]. Many countries around the world have long-standing traditional medicine that uses herbal therapies, dietary supplements, and alternative medical approaches. Individuals rely on traditional medicine, which has recently gained popularity, for most of their healthcare needs. [11]. Medicinal plants include a wide range of chemical components, which enables them to have a diverse range of pharmacological and therapeutic effects. These substances exemplify components such as tanning agents, glycosides, alkaloids, saponins, polysaccharides, essential oils, terpenoids, resins, and plant lipids [12-14]. Genetically modifying plants enables precise control over chemical concentrations, hence achieving the desired medicinal effect. Reverse genetics has several potential uses, including enhancing secondary metabolite synthesis, such as alkaloids [15].

Comment [N14]: Why discussing liver. What is the link of this paragraph with the immediate next one in the article.

Comment [N15]: Shift it with upper paragraph to make a flow of the introduction

Advancements in global scientific research have prompted more investigation into the therapeutic attributes of botanical species [16]. This is because plants are inherently safe, possess potent pharmacological properties, and provide a more economical alternative to synthetic medications.

Mimosa pudica L. (Mimosaceae) also referred to as touch me not, live and die, shame plant and humble plant is a prostrate or semi-erect subshrub of tropical America and Australia, also found in India heavily armed with recurved thorns and having sensitive soft grey green leaflets that fold and droop at night or when touched and cooled [17]. *M.pudica* L. is a creeping annual or perennial herb. It has been identified as lajjalu in Ayurveda and has been found to have antiasthmatic, aphrodisiac, analgesic, and antidepressant properties. *M. pudica* is known to possess sedative, emetic, and tonic properties, and has been used traditionally in the treatment of various ailments including alopecia, diarrhea, dysentery, insomnia, tumor, and various urogenital infections. Phytochemical studies on *M. pudica* have revealed the presence of alkaloids, non-protein amino acid (mimosine), flavonoids C-glycosides, sterols, terpenoids, tannins, and fatty acids [17,18]. In traditional folk agent that is utilized in the management of various diseases including cognitive dysfunction, demonstrated the improvement of memory in experimentally induced amnesia. The beneficial effects of *M. pudica* have been reported due to the presence of flavonoids, saponins, alkaloids, polyphenols, and steroids [19]. It has Wound healing activity, Regeneration of sciatic nerve, Antidepressant action, Anticonvulsant action, Hyperglycemic effect, Diuretic effect, Effect on uterine bleeding, Antifertility activity, Spasmogenetic potential, Antihepatotoxic and antioxidant potential, Antivenom activity, Antimicrobial properties and Aphrodisiac property [17,20,21,22].

The purpose of our present study is to evaluate the hepatoprotective effects of *Mimosa pudica*.

Materials and methods

Plant Collection and Extract Preparation

The specimens of *Mimosa pudica* were collected from a Dhaka-based market. The National Herbarium of Bangladesh confirmed the validity of the material. Rinsing Mimosa pudica well with water was the initial step, followed by letting it dry naturally. Lastly, the dried leaves were ground into a fine powder. The powder was soaked in 70% ethanol for fifteen days. For fifteen days, the solution was kept. Shaking, both intermittent and forceful, was also done. Filtration

Comment [N16]: This is too much basic data regarding herbal medicines. Reduce this paragraph to not more than 50 words.

Comment [N17]: Remove it. Focus on its medicinal uses and phtyochemicals espically those which are reported for its hyperlipidimic uses

Comment [N18]: Mention the name as per scientific method

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was then performed on the solution. A rotary evaporator was used to dry the collected filtrate under reduced pressure and temperature. In the end, the raw materials were tested for any relevant pharmaceuticals.

Comment [N24]: What was its specifications, conditions of evaporation and place where this step has been done

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Drugs and Chemicals

Atorvastatin drug was obtained from inceptapharmacetucals as a gift sample. Ethanol were bought from Taj Scientific store.

Comment [N27]: What was the trade names or numbers or specifications of these chemcials

Experimental Animal Procurement, Nursing, and Grouping

The 90 male rats, ranging in weight from 120 to 150 grams, were procured from Jahangirnagar University in Savar, Dhaka. The specimens were maintained in a controlled environment that varied the temperature by three degrees Celsius, the relative humidity by five and a half percent, and the length of the day and night by twelve hours. Institution of Nutrition and Food Science (INFS) at University of Dhaka supplied this setting. They were given regular food and were permitted to drink water that had been cleansed. In order to see how the animals adapted, they were housed in this habitat for at least one week prior to the study. All procedures used in the experiments were in accordance with the standards established by the IEAC. Nine groups, each with ten rats, were created from a pool of ninety rats.

Comment [N28]: Why only males. Why not female

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Experimental design

For the purpose of studying its anti-hyperlipidemic activity, rats were weighed individually and then split into nine separate groups. Each group had five rats, and the distribution of the animals was determined by their weight. Table 1 displays the atorvastatin control group, which consists of rats given atorvastatin in conjunction with a high-fat diet. This was done because administering the drug alone would have been fatal for the animals. The presence or absence of a therapeutic treatment in this group of rats is indicated by the value of N/A.

Table 1: Antihyperlipidemic activity analysis

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Group number	Group Status	Treatment specimen & Dose	Group Abbreviation
1	Negative Control	Physiological Saline	N

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2	HFD Control	High Fat Diet	P
3	High Fat Diet +RV_{10}	High Fat Diet + Atrovastatin	HFD + ATV
4	High Fat Diet+ *M. pudica*	High Fat Diet+ MP_{300}	HFD + MP_{300}
5	High Fat Diet+ *M. pudica*	High Fat Diet + MP_{600}	HFD + MP_{600}
6	High Fat Diet+ *M. pudica*	High Fat Diet + MP_{900}	HFD + MP_{900}
7	*M. pudica*	MP_{300}	MP_{300}
8	*M. pudica*	MP_{600}	MP_{600}
9	*M. pudica*	MP_{900}	MP_{900}

Shift data of this table 3 as self explanation of table 1 (instead of making a separate table)

High Fat Diet: The high-fat diet was modified based on the composition supplied by Levin and Dunn-Meynell. The high fat diet is composed of 50% lipid, 40% carbohydrate, and 10% protein. The diet's composition is shown in **Table 2**.

Table 2: Composition of high fat diet

Food Ingredients	**Composition**
Lipid (50%)	Milk powder (10%) Ghee (30%) Mutton fat (40%) Coconut oil (10%) Butter (10%)
Carbohydrate (40%)	Boiled rice (40%) Smashed potato (40%) Boiled corn (20%)
	Dry powdered prone (40%)

Comment [N35]: Concentration is missing here. Shift table 2 before table one or add table 2 as self explanation of this table (isntead of mentioning it as separate table)

Comment [N36]: What was its dosage

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Protein (10%)	Dry boiled mutton (20%) Cheese (20%) Egg (20%)

After mixing the ingredients thoroughly, the high fat diet was given to the rats to induce obesity for 10 weeks [23].

Evaluation of anti-hyperlipidemic Activity

Table 3: Application of treatment efficacy

Group Number	**Group Specification**	**Treatment species**	**Dose treatment species (mg/kg)**	**Abbreviation of Groups**
1	Negative control	Physiological saline	10 ml/kg	N
2	High Fat	N/A	N/A	HF
3	HF+RV_{10}	Rovast 10mg/kg	10	At_{10}
4	HF+MP_{300}	*M. pudica*	300	MP_{300}
5	HF+MP_{800}	*M. pudica*	600	MP_{600}
6	HF+MP_{900}	*M. pudica*	900	MP_{900}
7	MP_{300}	*M. pudica*	300	MP_{300}
8	MP_{600}	*M. pudica*	600	MP_{600}
9	MP_{900}	*M. pudica*	900	MP_{900}

For this experiment, 100 rats were randomly picked and equally divided into fourteen groups

Statistical analysis:

We used the spreadsheet program Microsoft Excel to record and analyze all of our results, or raw data, in terms of numerical parameters. Results were presented as mean SD after descriptive

Comment [N45]: Why this heading is separate

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Comment [N47]: correct its title as per available data in the table

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Comment [N49]: Remove this column as its already given in above table

Comment [N50]: same as comment N5

Comment [N51]: Use technical name, instead of brand name

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Comment [N53]: above one is statistical design of experiment but complete methodology showing which sample (blood or tissue etc) has been collected from above animals and which parameters has been assessed and which methods has been used to assess those paramters (mentioned in result section) by using above design is entirely missing.

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statistics were applied to the collected data. We utilized the "One-way Anova test" in SPSS 16 to analyze inter-group heterogenicity according to several biological parameters in order to determine statistical significance. The events are deemed to have occurred due to statistical significance as the 'p' value was lower than 0.05 ($p<0.5$).

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Results and discussion

Both ethnomedicine and traditional medicine have existed since the beginning of human civilization, and they involve the study of traditional medical practices among different ethnic groups. Historically, practitioners of traditional medicine relied on remedies made from organic substances. The traditional medicinal systems of various countries and civilizations mostly relied on herbal remedies, which consist of plants or plant-derived substances, including plant extracts. For a long time, traditional medicines have relied on extracts or isolated active compounds derived from plants and herbs. This study examined the impact of an extract derived from *Mimosa pudica*on lipid profiles using a rat model of hyperlipidemia induced by a high-fat diet. Group 6, which consumed a high amount of fat at a rate of 900 mg/kg, exhibited statistically significant findings ($p< 0.05$) in SGPT levels. The SGOT did not generate statistically meaningful findings. Two additional investigations reached identical conclusions [24, 25]. The renal function test results showed that group 6, which received dosages of 900 mg/kg, exhibited significantly elevated levels of urea ($p< 0.05$). The creatinine analysis in groups 4, 5, and 6 showed statistically significant results ($p< 0.05$) for dosages of 300, 600, and 900 mg/kg, respectively. The findings of two distinct inquiries on the matter were indistinguishable [26, 27]. Groups 5 and 6 exhibited statistically significant results ($p<0.05$) regarding HDL and LDL. The results were statistically significant in groups 5 and 6, respectively, when administered dosages of 600 and 900 mg/kg. A substantial statistical difference ($p< 0.05$) was seen in the triglyceride levels between groups 5 and 6. The total cholesterol levels in Group 6, which received a dosage of 900 mg/kg, showed statistically significant results ($p< 0.05$). The results were identical in two other investigations [28, 29].

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Table 4: Lipid profile of*M. pudica*

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Comment [N64]: Lipid profile of animal or plant. Correct it

Groups	SGPT	SGOT	Creatinine	Urea	TC	HDL	LDL	TG
NC	33.67±3.26	38.21±4.23	0.53±0.24	37.42±4.10	125.24±6.90	84.74±4.90	38.42±3.38	47.29±18
HFD	86.96±7.24	89.30±7.52	2.89±0.83	102.36±9.36	229.46±12.41	41.46±3.30	146.39±13.49	114.79±13.26
HFD+ RV_{10}	58.24±5.73	62.46±5.23	1.46±0.63	57.57±8.26	161.46±11.93	65.53±5.53	80.22±10.53	66.43±93
HFD+MP_{300}	85.75±6.91	89.10±4.91	2.32±0.64*	100.46±8.62	226.20±8.78	44.26±5.59	142.20±13.43	110.21±6.97
HFD+MP_{600}	82.21±4.81	87.54±5.36	2.01±0.79*	97.39±7.70	221.34±9.91	49.39±6.90*	136.79±12.21*	104.36±7.47*
HFD+MP_{900}	80.42±3.75*	86.86±6.29	1.89±0.63*	93.10±6.61*	215.53±7.07*	54.26±8.29*	131.29±14.79*	96.24±90*
MP_{300}	35.22±2.16	37.30±3.31	0.63±0.37	35.50±3.63	127.73±6.24	82.82±4.39	39.59±4.57	49.21±93
MP_{600}	31.67±4.26	35.50±4.02	0.68±0.52	38.26±4.67	121.93±5.73	84.63±5.53	36.63±5.57	44.22±50
MP_{900}	35.57±3.26	36.31±3.40	0.54±0.83	32.29±3.17	126.22±6.78	83.19±2.93	33.27±6.21	47.70±22

Note: The results were expressed in Mean±SEM (standard mean error) *p< 0.05, **p< 0.01, and ***p< 0.001 were considered as statistically significant. The statistical analysis followed by one-way analysis of variance (Dunnett's test) compared to the control.

Conclusion

The hepatoprotective effects of an ethanolic *M. pudica* extract were the primary research focuses here. According to the results of this study, an ethanol extract of the *M. pudica* plant may offer protection against high cholesterol, liver damage, and impaired kidney function. To determine which components of the total extract are responsible for the beneficial effects on hyperlipidemia and diabetes, additional studies are required. A extensive investigation can be carried out once the active substances have been identified.

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Comment [N83]: Conclude results, instead of giving a general comment on above study

Comment [N84]: Use scientific method to write name of extract

Comment [N85]: How you proved it from one small study.

References:

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Comment [N86]: All references are not on one format

Comment [N87]: Too advance (2024 or 2023) references has been mentioned in this list but there data has not been cited in the article (complete article shows that too old data has been cited actually)

Comment [N88]: Replace all the data which has been cited from the references before 2019, which advance one (after 2019)

Comment [N89]: Names and abbriviations of chemicals are not as per rules of IUPAC.

Comment [N90]: Scientific names of plants are written in non-scientific way in all references