Original Research Article

Evaluation of the Effects of Ethanolic extract of *Ficus benghalensis* on the Lipid profile and Kidney function in Rat Model

Abstract

Almost since the dawn of human civilization, people have been employing herbal medicine as a means of treatment for various ailments. The anti-diabetic properties and lipid profile of *Ficus benghalensis* were investigated in this research. The anti-diabetic activity was measured by using the alloxan-induced diabetic approach. When compared to the control group, the doses of 500 mg/kg and 1000 mg/kg exhibited statistically significant ($p<0.05$) results in terms of their ability to inhibit the development of diabetes. In the case of total cholesterol, High density Lipoprotein (HDL) and Low density Lipoprotein (LDL) groups 3,5 and 6 with doses of 100 mg/kg, 500 mg/kg, and 1000 mg exhibited outcomes that were statistically significant. In the case of triglycerides, the findings indicated that SGOT (Serum glutamic oxaloacetic transaminase) and SGPT (Serum glutamate pyruvate transaminase)group 4 and 5 with doses of 250 mg/kg and 500 mg/kg were statistically significant ($p<0.05$). The findings of the kidney function test showed that group 4, which received a dosage of 250mg/kg, had statistically significant ($p<0.05$) outcomes. According to the results, *Ficus benghalensis* has the potential to be used in the development of standardised phytomedicine for the treatment of patients suffering from diabetes, cardiovascular disease, liver disease, and renal sickness.

Keywords: Herbal medicine, *Ficus benghalensis*,SGPT,HDL,Diabetes.

UNDER PEER REVIEW

Introduction

When glucose levels in the blood are consistently high, a disease known as diabetes develops. When this happens, insulin production and action are both impaired. The metabolic disorder known as diabetes mellitus is defined by long-term high blood sugar levels due to problems with the metabolism of carbohydrates, lipids, and proteins, which in turn lead to insulin resistance, insufficiency, or both [1]. Diabetic complications include insulin resistance and beta-cell loss in

the pancreas [2]. In 2017, there were about 462 million individuals living with type 2 diabetes, with a prevalence rate of 6059 cases per 100,000. Among those affected, 4.4% were in the 15–49 age group, 15% were in the 50–69 age group, and 22.0% were 70 and over. With more than one million lives lost every year, diabetes ranks as the ninth-leading killer. Although the rate of rise is fastest in industrialized nations and Western Europe, the incidence of diabetes mellitus is rising globally [3]. Acarbose, alpha-glucosidase, thiazolidinedione, biguanides, sulphonylureas, and meglitinides are among the many oral drugs used to treat diabetes [4]. Serious adverse effects, such as hypoglycemia, heart failure, gastrointestinal issues, fractured bones, and liver damage, are nevertheless possible with these drugs [5]. Not only may these synthetic drugs have deadly side effects, but the hefty cost of therapy can prevent the patient from finishing the whole course.

For as long as there have been people, they have relied on medicinal herbs. The extensive history of humankind's search for therapeutic substances in nature is attested to by documents, historical buildings, and even the original plant cures. [6]. Medical plant researchers have shown that some plant-derived chemicals may have medical uses. Therefore, researchers are continuously seeking herbal remedies derived from plants as a means to alleviate a broad variety of medical conditions. Many different chemical components, including phenols, alkaloids, terpenoids, saponins, glycosides, tannins, flavonoids, resins, polysaccharides, plant lipids, essential oils, and many more, allow these medicinal plants to exert a broad variety of pharmacological and therapeutic effects. [7]. One possible therapeutic outcome of plant genetic modification is an alteration in the concentration of the plant's chemical components, either an increase or a decrease. One use of reverse genetics is the enhancement of secondary metabolite biosynthesis, including alkaloid production. [8].

Ficus benghalensis, a member of the Moraceae family, is a tree that is usually referred to as the banyan, banyan fig, or Indian banyan. It is indigenous to the region. Tannins, alkaloids, and carbohydrates. Phytosterols, flavonoids, terpenoids, phenolic compounds, and other similar substances [9, 10]. It has analgesic, anti-inflammatory, anti-helmintic, antioxidant, antifungal, anti-tumour, wound healing, and anti-diabetic properties [11, 12]. Studies have shown that phenolic compounds inhibit the enzymes alpha-amylase and alpha-glucosidase, leading to

UNDER PEER REVIEW

antidiabetic effects [13]. The total phenolic content (TPC) in plants may be the reason for this possible antidiabetic action [14].

The goal of this study was to find out how well an ethanolic extract from *Ficus benghalensis* woks against diabetes and lipid profile.

Methods and material

Drugs, chemicals, and instruments

The ethanol and alloxan was bought from the German company Sigma-Aldrich. Healthcare Pharmaceutical Limited sent us a complimentary sample of metformin, a commonly used medication for diabetes. Plasmatic Laboratory Product Ltd. of the UK supplied the HDL, LDL, triglyceride, SGOT, SGPT, and creatinine blood serum analysis kits. Shahbag in Dhaka, Bangladesh, provided the Alere GI glucometer from Alere Inc., USA, and the Humalyzer 3000, a semi-automated clinical chemistry analyzer, was used to assess the biochemical parameters such as HDL,LDL, Cholesterol etc.

Plant collection and extraction

The leaves of *Ficus benghalensis* were gathered in three different places in Bangladesh: North Bengal, a hilly area, and a lowland area. The next step included authentication and taxonomic identification. The researchers complied with Bangladeshi legislation and kept the plant specimen at the National Herbarium. The leaves were dried in the shade for seven to ten days before being finely powdered. During the steeping process in 70% ethanol, we vigorously stirred the powdered leaves for 7 days. After completing the soaking process, we filtered the extract and collected the filtered liquid. The researchers concentrated the extracted solution using a rotary evaporator. Afterwards, the dried extract was carefully collected and preserved for the future use.

Experimental animal handling

Male Wistar rats weighing between 125 and 200 grams were obtained from the Pharmacy Department of Jahangirnagar University in Dhaka, Bangladesh. The rats were housed in the Institute of Nutrition and Food Science at the University of Dhaka under a 12-hour light/dark cycle and maintained at a constant temperature of 25°C. The rats were provided with a standard

UNDER PEER REVIEW

pellet diet and freshwater. In order to prepare the rats for the experiment, they were housed in such an environment. We adhered to the protocols established by the Institutional Animal Ethics Committee (IEAC) in all rat experiments. The ethical approval was taken from the East West University, Department of Pharmacy with the issue no 147/pharm.science.ewu.The Swiss Academy of Sciences (SCNAT) and the Swiss Academy of Medical Sciences (SAMS) established protocols for the care and handling of animals.

Experimental guideline

We followed the guidelines laid forth in the 2013 Declaration of Helsinki while conducting all of our testing. We maintained strict adherence to the "3R" criteria, which form the basis of Swiss and international laws controlling the use of animals in research, throughout the course of this investigation. Rats had their tail tips massaged with isopropyl alcohol both before and after blood glucose level measurements to alleviate pinching pain and make the procedure more bearable. The rats were put to sleep in a painless manner after they had been fed properly during the experiment.

Experimental design

The results of the anti-hyperglycemic activity tests conducted on rats, which were individually weighed and then grouped according to body weight, are shown in Table 2. Ten rats per group were used to classify the rats according to their weight. Table 1 shows the alloxan-only group of rats as the control group. The rats in this group did not receive any therapeutic treatment for 10-12 days, as shown by the absence of a value.

Statistical Analysis

The statistical significance of intergroupheterogeneity was evaluated using the "one-wayANOVA test" to compare the groups across arange of biological characteristics. The "SPSS16" application was used for the analysis.Results were considered statistically significantwhen the "p" value was less than 0.05 ($p< 0.05$)and highly significant when the "p" value wasless than 0.01 ($p <0.01$).

Table 1: Anti-diabetic activity analysis

Group number	**Group Status**	**Treatment specimen**	**Dose of treatment specimen (mg/kg)**	**Group Abbreviation**
1	Negative Control	Physiological Saline	10 mL/kg	N
2	Alloxan control	Alloxan	150 mg/kg	A
3	Alloxan + Metformin	Alloxan + Metformin	150 mg/kg + 100mg	A + M100
4	Alloxan + *F. benghalensis*	Alloxan + *F. benghalensis*leaves extract low dose	150 mg/kg + 500 mg/kg	A + FB_{500}
5	Alloxan + *F. benghalensis*	Alloxan + *F. benghalensis* leaves extract medium dose	150 mg/kg + 1000 mg/kg	A + FB_{1000}
6	Alloxan + *F. benghalensis*	Alloxan + *F. benghalensis* leaves extract high dose	150 mg/kg + 1500 mg/kg	A+FB_{1500}
7	Metformin	Metformin	100 mg/kg	M
8	*F. benghalensis*	*F. benghalensis* leaves extract low dose	500 mg/kg	FB_{500}
9	*F. benghalensis*	*F. benghalensis* leaves extract medium dose	1000 mg/kg	FB_{1000}
10	*F. benghalensis*	*F. benghalensis* leaves extract high	1500 mg/kg	FB_{1500}

UNDER PEER REVIEW

		dose		

Biological sample collection

Blood samples were collected from a rat's tail to measure blood glucose levels. We punctured a rat's tail to obtain blood samples for measuring blood glucose levels. On the other hand, blood was drawn from the animal as soon as its heart was punctured and transferred to a micro-centrifuge tube after the rats were sacrificed. Following 5 minutes of centrifugation at 5,000 rpm, the collected samples yielded the supernatant fluid. For biochemical testing, this fluid was then transferred to an additional microcentrifuge tube. After sacrificing the animals, we quickly extracted and carefully cleansed their organs in ice-cold saline to assess their function.

Estimation of Biochemical Parameters

By using a glucometer, the blood glucose level was ascertained. The Humaluzer 3000 was one of many tests administered, along with those for the lipid profile (HDL, LDL,Cholesterol, triglyceride|), kidneys (Urea, Creatinine), and liver (SGPT and SGOT). We also tested liver and kidney samples for gluconeogenic and glycolytic enzyme activity.

Statistical Analysis.

For each group, the mean and standard deviation (SD) of each research parameter are displayed. The "one-way ANOVA test" was used to examine the statistical significance of intergroup heterogeneity by evaluating differences across groups in terms of different biological parameters. The application "SPSS 16" was used for the analysis. The result was considered statistically significant when the "P" value was less than 0.05 ($p<0.05$) and highly significant when it was less than 0.01 ($p <0.01$).

Results and Discussion

Table 2: Biochemical profile of mice after the administration of different dose of extract

	Total Cholesterol(IU/L)	HDL (IU/L)	LDL(IU/L)	Triglyceride (IU/L)	SGPT(IU/L)	SGOT(IU/L)	Urea(IU/L)	Creatinine(IU/L)

UNDER PEER REVIEW

N	94.22±4.15	70.46±2.20	35.19 ±4.10	52.40±2.32	35.20±1.29	46.21±2.46	28.40±3.09	0.7±0 .09
A	142.32±5.19	47.30±3.15	75.63±4.88	109.43±4.50	84.53±4.20	93.45±4.26 *	99.43±9.35	2.5±0 .08
A+M_{100}	112.22±4.36	61.29±4.20	60.70±3.26*	68.57±5.26	62.60±3.29	58.50±4.29	62.40±4.59	1.4±0 .06
A+FB_{250}	140.50±4.23	48.33±2.08	74.91±4.24	106.42±2.21 *	82.20±3.19	90.46±5.57	96.93±2.41	2.1±0 .08*
A+FB_{500}	135.29±6.18*	53.29±1.80*	71.29±2.99*	98.25±2.49*	79.20±2.19 *	89.24±7.29	92.17±4.43	1.6±0 .07
A+F_{B1000}	130.22±4.36*	57±4.01*	66.36±4.16*	91.70±3.30*	74.51±4.53	85.29±6.18	86.21±3.22	1.2±0 .06
M_{100}	92.59±5.50	70.22±3.18	36.25±3.21	55..59±2.30	36.65±2.26	44.56±1.82	25.23±2.10	0.5±0 .05
FB_{250}	95.40±4.25	73.87±4.9	37.66±1.66	57.20±2.10	31.49±3.56	43.19±2.80	29.91±1.93	0.7±0 .08
FB_{500}	97.90±5.30	70.46±3.25	38.34±2.45	53.25±3.83	33.30±4.26	49.65±3.24	20.46±2.20	0.7±0 .06
FB_{1000}	92.25±4.63	72.18±4.50	32.35±3.29	57.10±2.85	35.43±2.25	46.33±4.22	27.51±2.95	0.8±0 .09

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. M=Metformin, FB= *Ficus benghalensis*.

When people talk about using medicinal plants to cure or prevent disease, they're referring to herbal medicine. This method incorporates a broad range of therapies, from conventional to alternative and from popular to traditional, from all over the world. It also makes use of concentrated and standardized plant extracts. This study examined the lipid profile and antidiabetic effectiveness of *Ficus benghalensis* in mice. Diabetes continues to be a major health concern in modern times. In addition to increasing disability and healthcare costs, macro- and microvascular complications of diabetes are a leading cause of death. As shown in Figure 1, there was a statistically significant ($p<0.05$) difference between the control group and the groups

UNDER PEER REVIEW

given dosages of 500 mg/kg and 1000 mg/kg in terms of antidiabetic effectiveness. Other studies using animal models and in vitro research came to similar conclusions [15-18].

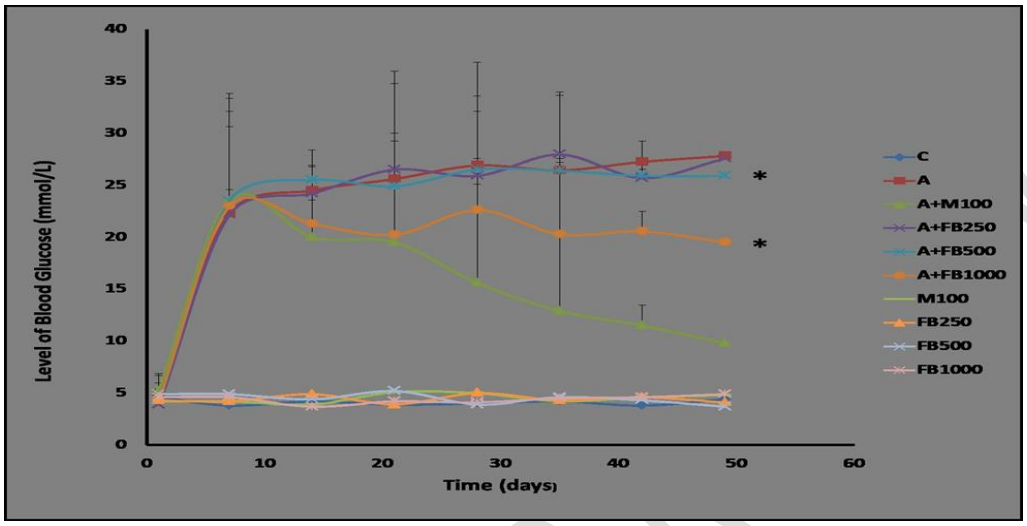

Figure 1: Antidiabetic activity of different dose of *Ficus benghalensis*

Groups 3,5 and 6, administered 100 mg/kg, 500 mg/kg, and 1000 mg of HDL and LDL, respectively, showed statistically significant results for total cholesterol. Similar results were observed for *Ficus religiosa* [19]. The results showed that when it came to triglycerides, groups 4 and 5 with dosages of 250 mg/kg and 500 mg/kg of SGPT and SGOT, respectively, were statistically significant ($p<0.05$). The results of the first investigation and two subsequent trials on *F. benghalensis* [20, 21] were quite similar. Statistically significant ($p<0.05$) results were seen in group 4, which was given a dose of 250 milligrams per kilogram, according to the kidney function test results. An additional analysis of *F. benghalensis*[22] yielded similar results.

Conclusion

This research found that there may be potential benefits to ethanol-extracted *Ficus benghalensis* for the prevention of diabetes, hyperlipidemia, liver damage, and renal function. It has dose-dependent anti-diabetic and anti-hyperlipidemic effects. To exert its anti-diabetic and anti-hyperlipidemic effects, researchers need to conduct further research to determine the active

UNDER PEER REVIEW

component of the whole extract. Researchers will be able to do further in-depth studies when they have isolated the active chemicals.

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UNDER PEER REVIEW

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UNDER PEER REVIEW

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UNDER PEER REVIEW