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Research Article

Antidiabetic Activities of Extracts of *Ficus bengalensis* Linn

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Abstract

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Abstract: Various extracts of diverse parts of medicinal plants have been shown to possess antidiabetic and hypoglycemic effect. Most of them look to act directly on pancreas (pancreatic effect) and stimulate insulin level in blood. Some have extra pancreatic effect by acting directly on tissues like liver, muscle, etc and alter favorably, the activities of the regulatory enzymes of glycolysis, gluconeogenesis and other pathways. The research work embodied in the thesis deals with the scientific exploration of indigenous plants viz., *Ficus bengalensis* Linn for their possible anti-diabetic and hypoglycemic activity. The present investigations concluded that the ethanolic and aqueous extracts of aerial parts of *Ficus bengalensis* Linn endowed with potential antidiabetic activity which could be attributed by their possible multiple effects on both pancreatic and extra-pancreatic site by influencing either the metabolism and/or absorption of glucose, which in turn also influence the lipid metabolism.

Keywords: hypoglycemic, *Ficus bengalensis* Linn, Diabetic, Lipid metabolism

INTRODUCTION

Before the advent of insulin, diabetes was treated with plant medicines. The plant kingdom represents a largely unexplored reservoir of biologically active compounds not only as drugs, but also as unique templates that could serve as a starting point for synthetic analogs and an interesting tool that can be applied for a better understanding of biological processes. Folkloric uses are supported by a long history of human experience ¹. Numerous biologically active plants are discovered by evaluation of ethno-pharmacological data, and these plants may offer the local population immediately accessible therapeutic products. Numerous plants have been used for the treatment of diabetes mellitus in Indian system of medicine and in other prehistoric systems of the world, out of these only some have been evaluated as per the present system of medicine. From several such plants only extracts have been prepared and their effectiveness evaluated in experimental diabetes in animals ². Most of them seem to act directly on pancreas (pancreatic effect) and stimulate insulin level in blood. Several have extra-pancreatic effect by acting directly on tissues like liver, muscle etc. and change favorably the activities of the regulatory enzymes of glycolysis, gluconeogenesis and other pathways. Many of its products / chemical constituents are known to possess a wide range of medicinal properties. Renewed attention to alternative medicines and natural therapies has stimulated a new wave of research interest in traditional practices. In the last 20 years, scientific investigation has confirmed the efficacy of many of these preparations, some of which are remarkably effective. In

the present study, we investigated the antidiabetic and antioxidant properties of different extracts and fractions of aerial parts of *Ficus bengalensis* Linn ³ on normal and alloxan induced ⁴ diabetic rats.

MATERIALS AND METHODS:

Plant material:

The selection of plant species for our study was based on their traditional use for diabetes treatment, the information being gathered from published sources and traditional healers. The plants aerial parts of *Ficus bengalensis* Linn was selected for the present studies.

Collection, identification and authentication of plant parts:

Fresh and mature plant of *Ficus bengalensis* Linn was, collected from the road side area from Indore M.P., India, during summer (April, 2010) and was authenticated by the Taxonomist. The voucher specimens of *Ficus bengalensis* Linn has been preserved in the institution herbarium of school of pharmaceutical sciences, siksha 'O' anusandhan university for future reference. After due authentication, fresh matured aerial parts *Ficus bengalensis* Linn L was collected in bulk, initially rinsed thoroughly with distilled water, shade dried for 15 days. The shade dried materials were coarsely powder by a mechanical grinder and preserved in a nylon bag in a deep freezer, till further use.

METHODS:

Preparation of extracts

The extraction yield of the extracts from plant species is vastly depends on the solvent polarity, which find out both qualitatively and quantitatively the extracted compounds. Ethanol and water are the commonly used solvent for the extraction because of their low toxicity and high extraction yield with the advantage of modulating the polarity of the solvent by using mixtures at different ratios ⁵. The plant materials (1 kg) were initially defatted with petroleum ether and then extracted with alcohol and water using a Soxhlet apparatus. The yield of the plant extracts ethanol (95%) and aqueous measured about 20 g each after evaporating the solvent using water bath. The standard extracts obtained from *Ficus bengalensis* Linn were then stored in a refrigerator at 4°C for further use for phytochemical investigation and pharmacological screening ⁶.

Animals: Healthy adult Male albino Wistar rats, weighing 150–200 g and Swiss albino mice, weighing 20–25 g were used for the Screening methods.

Investigational model for induction of diabetes: Diabetes was induced by intra-peritoneal injection of Alloxan monohydrate (150 mg/kg b.w.) dissolved in the in normal saline ⁷ Blood was withdrawn (0.1 ml) from the tip of the tail of each rat under mild ether anaesthesia. The blood glucose level was checked before alloxanisation and after alloxanisation regularly in 24h intervals. Animals were considered diabetic when the blood glucose level was raised beyond 200 mg/100 ml of blood. This condition was observed at the end of 72 h after alloxanisation.

Preparation of Interventions: The measured quantity of extracts and fractions of *Ficus bengalensis* Linn and the standard drug glibenclamide (5 mg/kg) was suspended in 25% Tween-20 in distilled water. The solvent, test samples and standard drugs were administered by oral route based on dose and corresponding weight of the animals. For oral administration of test, standard as well as Solvent Feeding needle no 21 was used.

Preliminary phytochemical investigation of extracts: The different qualitative chemical tests were performed for establishing profile of extracts and fractions for their chemical composition. The following tests were performed by standard & prescribed chemical procedure on extracts to detect the various phytoconstituents present in them ⁸⁻¹⁰.

Blood glucose level determination: Fasting blood glucose concentration was determined using a Glucometer (Optium), based on the glucose oxidase method. Blood samples were collected from the tip of tail at the defined time patterns ^{11,12}.

Antihyperglycemic activity of extracts in glucose-loaded animals (oral glucose tolerance test): The oral glucose tolerance test (OGTT) measures the body's ability to use main source of energy i.e. glucose. OGTT is to simplify and facilitate the diagnosis of diabetes ¹³. This method is frequently referred to as physiological induction of diabetes mellitus because the blood glucose level of the animal is fleetingly increased with no damage to the pancreas. An oral glucose tolerance test (OGTT) was performed on diabetic rats by feeding glucose (5 g/kg) per os. Animals were deprived of food 18 h before and during the experiment, but were allowed free access to water. They were divided into 7 groups of 6 rats each. Group I served as normal control, Group II served as solvent control and received only vehicle (Tween + water - 2 ml/kg b.w.) through the oral route. Group III received glibenclamide (5 mg/kg b.w.). Groups IV to VII received the alcohol and aqueous extracts of *Ficus bengalensis* Linn at a dose of 200 and 400 mg/kg b.w., respectively, through oral route. The blood glucose level was determined before drug and glucose administration (–1 and 0 h, respectively) and subsequently at 0.5, 1, 2 and 3h after.

Statistical analysis:

The data were expressed as mean ± SEM. All the data were analyzed by one way analysis of variance (ANOVA) followed by “Dunnet's t-test.” *p*-value less than 0.05 was considered as statistically significant.

RESULTS AND DISCUSSION:

Preliminary phytochemical study of the *Ficus bengalensis* Linn extracts/fractions: The medicinal plants *Ficus bengalensis* are useful for healing as well as for curing of human diseases because of the presence of phytochemical constituents. The preliminary phytochemical screening was carried out to assess the qualitative chemical composition of crude extracts and fractions from by using precipitation and coloration reaction to identify the major natural chemical groups ^{12, 13}. General reactions in this analysis revealed the presence or absence of these compounds in the crude extracts and fractions tested.

Table- 1: Phytochemical screening of extracts and fractions of *Ficus bengalensis* Linn

Chemical constituents	Chemical Test	Extracts/Fractions			
		Ethanol extract	Aqueous extracts	Chloroform fraction	Aqueous fraction
Alkaloids	Mayer's	+	+	+	+
	Dragendorff's	+	+	+	+
	Wagner's	-	-	-	-
	Hager's	+	+	+	+
saponin	Foam	-	+	-	-
	Haemolytic	-	-	-	-
Phenolic compounds and Tannins	Ferric Chloride	+	+	+	+
	Gelatin	-	-	-	-
	Lead acetate test	+	+	+	+
Proteins	Million's	+	-	+	-
	Biuret	+	+	+	-
	Xanthoprotein	-	-	-	-
Flavonoids	Ferric Chloride	+	+	-	+
	Shinoda	-	-	-	-

	Lead Acetate	+	+	+	+
Glycoside	Baljet's	-	-	-	-
	Legal's	-	-	-	-
	Borntrager's	-	-	-	-
	Killer killani	-	-	-	-
Fixed oil	Spot	-	-	-	-
Carbohydrate	Molisch's	-	-	-	-
	Fehling's	+	+	+	+
	Benedict's	-	-	-	-
	Barfoed's	+	+	+	+
	Cobalt-chloride	-	-	-	-
Gums and mucilage	Swelling Index	-	-	-	-
Amino Acids	Ninhydrin	-	-	-	-
	Tyrosin	-	-	-	-
	Tryptophan	-	-	-	-
Sterols and triterpenes	Liebermann-Burchard's	+	+	+	-
	Salkowski's	+	-	+	-

Key (+) = Presence, (-) = Absent

Effect of various extracts of *Ficus bengalensis* Linn on BGL of glucose loaded hyperglycemic rats (oral glucose tolerance test, OGTT):

The effect of the test extracts on blood glucose level (BGL) in OGTT is depicted in Table 2. The ethanol and aqueous extracts at 200 mg/kg dose level registered 92.13, 95.50 mg/dl at the end of 3 h of the study, while it was 91.50, 96.53 mg/dl with dose level of 400 mg/kg. However, at the same time the standard drug glibenclamide at 5mg/kg showed 62.51 mg/dl of BGL. However the calculated percentage fall of BGL demonstrated 6.22, 18.26 and 14.73, 24.79% with respect to

200 and 400 mg/kg dose levels when measured at the end of the 3 h of the study, while at the same time glibenclamide showed a 30.10% fall of BGL. The progressive fall of BGL of the test extracts, in the different test hour showed a statistical significant of $p < 0.05$ to $p < 0.01$, while analyzed by using ANOVA followed by Dunnett's t-test. The aqueous extract possesses more BG lowering potency than that of the ethanol extract in a dose dependent manner. The test extracts at tested dose levels also showed a significant fall of BGL while compared with solvent control group during the study period of 30, 60 and 120 min.

Table- 2: Effect of ethanolic and aqueous extracts of *Ficus bengalensis* Linn on oral glucose tolerance in normal rats

Gr.	Treatment and dose	Blood glucose concentration (mg/dl)					% decrease at end of 3hr
		0 min	30 min	60 min	120 min	180 min	
I	Normal Control	83.75 ± 0.47	86.50 ± 0.84	88.50 ± 1.56	83.50 ± 0.98	86.50 ± 1.47	--
II	Solvent control	90.50 ± 0.64	135.52 ± 0.64**	118.83 ± 0.85**	98.50 ± 0.61**	91.50 ± 0.24**	--
III	Glibenclamide (5mg/kg)	89.43 ± 0.40	95.50 ± 1.04**	81.53 ± 0.91**	72.50 ± 0.64**	62.51 ± 0.66**	30.10
IV	Eth. Ext. (200mg/kg)	83.62 ± 1.78	98.25 ± 0.85**	97.61 ± 1.91**	93.50 ± 1.63**	92.13 ± 0.95	6.22
V	Eth. Ext. (400mg/kg)	87.50 ± 0.89	107.31 ± 1.37**	102.32 ± 1.10**	94.50 ± 0.54*	91.50 ± 0.54	14.73
VI	Aq. Ext. (200mg/kg)	91.50 ± 0.64	116.84 ± 1.10**	109.83 ± 0.85**	102.65 ± 1.91*	95.50 ± 0.64*	18.26
VII	Aq. Ext. (400mg/kg)	84.87 ± 0.91	128.36 ± 0.85**	117.36 ± 1.70	103.51 ± 0.77**	96.53 ± 1.27**	24.79

Values are expressed in MEAN ± S.E.M of six animals. One Way ANOVA followed by Dunnet's t-test (t-value denotes statistical significance at * $p < 0.05$, ** $p < 0.01$ respectively, in comparison to group-II)

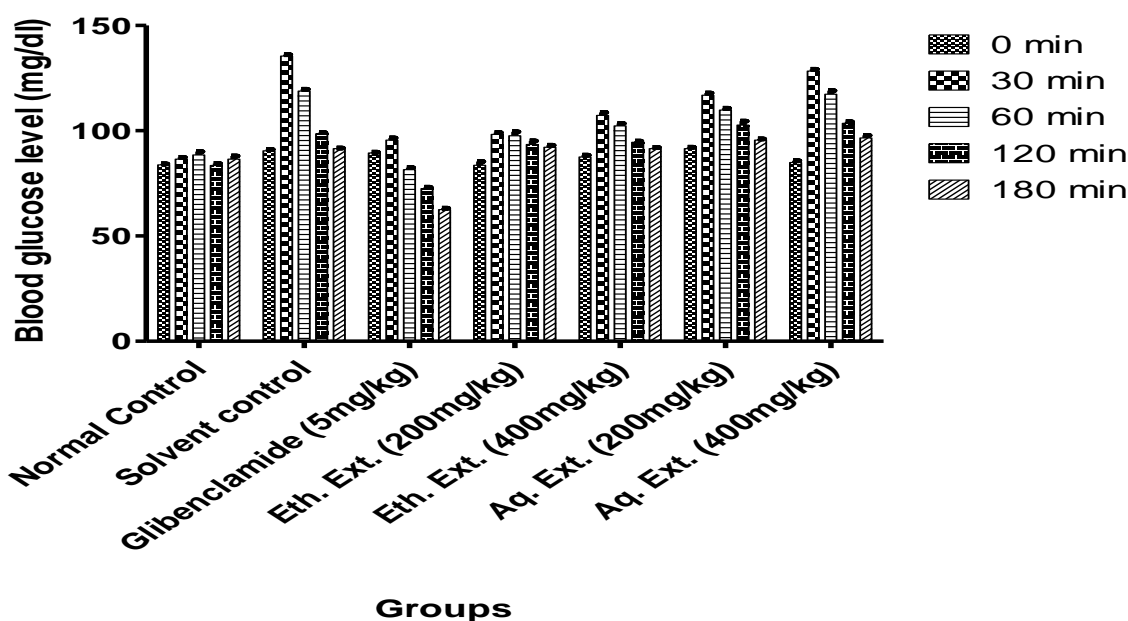


Figure 1: Effect of ethanolic and aqueous extracts of *Ficus bengalensis* Linn on oral glucose tolerance in normal rats

CONCLUSION:

The dose levels of the each extract were selected based on the results of the acute toxicity study and found as: for *ficus bengalensis* linn, it is 200 & 400 mg/kg b. w. since both ethanolic and aqueous extracts showed good activity, hence the investigators think it may be more worth full in terms of its bg lowering ability, if we consider hydro-alcoholic extract instead of individual extract. in the above context we have prepared hydro-alcoholic extract of both the plant materials separately and based on the acute study report the test dose levels were fixed as same like that of individual extract as mentioned above. the preliminary study reports in the direction of the antidiabetic activity of all test extracts demonstrate that, the hydro-alcoholic extract is showing better response, in term enforced us to study the hydro-alcoholic extract in a more scientific manner, therefore different fractions were prepared from the hydro-alcoholic extract and were used for more detail study in respect of its anti-diabetic potential.

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