Evaluation of Anti-diabetic effect of *Jasminum polyanthum* hydroalcoholic extract on streptozotocin induced diabetic rats

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ABSTRACT

Background: Currently, there is a demand for new antidiabetic drugs from natural sources and diabetes mellitus disease is global epidemic now. The flower of *Jasminum polyanthum* has been used in various traditional system medicine for its valuable therapeutic uses.

Aim: The aim of the present study is to evaluate the anti-diabetic effect of the *Jasminum polyanthum* hydroalcoholic extract on streptozotocin induced diabetic rats.

Material and method: The flower of *Jasminum polyanthum*(JP) was collected from Villupurm, Tamilnadu, and dried in shade.The dried flower was powdered in a blender and it was extracted using soxhlet,hydroalcoholic solvent was used(80:20). Animals are divided into five group each contain six animals. Streptozotocin (40mg/kg) dose is used for inducing diabetes in wistar male rats. Treatment with Glibenclamide and JP hydroalcoholic extract (200mg and 400mg/kg) was for 21 days body weight, food intake, water intake and blood glucose level was observed. The blood concentrations of TC, TG, LDL, VLDL and HDL was done. Antioxidant activity of Superoxide dismutase (SOD), glutathione reductase (GR), Catalase(CAT) was carried out using pancreatic supernatant. Histopathology examination was done on pancreas.

Results: The extract of *Jasminum polyanthum* and standard shows normal intake of food and water but body weight was slightly increased. There was a significant ($p < 0.001$ and ns) decrease in blood glucose level at doses of 200 mg/kg and 400mg/kg when compared with STD group. The observation was carried out on 0^{th}, 3^{rd}, 7^{th}, 14th, 21st and 28^{th} day. On 28^{th} day the animals were sacrificed and pancreas were homogenized, supernatant was tested for antioxidant Superoxide dismutase (SOD), glutathione reductase (GR), Catalase (CAT) in which significantly ($p<0.001$) increased. Lipid profile showed significant increase in HDL cholesterol and significant decrease ($p < 0.01$) in TC, VLDL, LDL, TG were observed**.** Histopathology examination confirmed the restoration of β-cells of the islets of Langerhans and regeneration of β-cells were found to be increased.

Conclusion: The present study shows that the hydroalcoholic flower extract of *Jasminum polyanthum* has antidiabetic, and antioxidant activity.

Keywords: *Jasminum polyanthum*, Streptozotocin, Glibenclamide, Anti diabetic activity, Anti-oxidants

INTRODUCTION:

Diabetes is a chronic, metabolic disorder characterized by elevated levels of blood glucose, which leads over time to serious damage to the heart, blood vessels, eyes, kidneys and nerves.Type-1 DM (insulin-dependent DM) because of insulin deficiency and type-2 DM (non-insulin-dependent DM) caused by insulin resistance are the chief categoriesof types of DM. Insulin-dependent type 1 DM is the outcome of interactions of environmental, genetic,[1,2] and immunological factors which lead to the annihilation of the pancreatic beta cells resulting in insulin deficiency. Non-insulin-dependent type 2 diabetes is the extremely regular type and is related with hyperinsulinemia, insulin resistance,and obesity.[3]The number of people with diabetes in India has increased from 26 million in 1990 to 75 million in 2021. The prevalence of diabetes is 6.5% and prediabetes 5.7% among the adults below the age of 50 years, according to the DHS survey [4].Diabetes and its complications are leading causes of death worldwide [5]. Many people believe in traditional ways of living, and this influences their health-seeking behavior. Traditional medicines, which include normal foods and herbs, are used as the main form of primary health care. Studies reported that 80% of people in developing countries depend on traditional medicines as the primary remedy for various ailments [6].Natural herbal products separately or in combinationwith the oral hypoglycemics produce an effective therapeuticresponse in certain contrary cases where the modern medicinealone fails. Many herbal extracts are known to have hypoglycemic effects [7]. Almost all jasmine species are ingredient for Ayurvedic species having curing qualities. It is used for removing intestinal worms. It is widely used for venereal diseases. Flowers are used to treat ulcers, vesicles, boils, skin diseases and eye disorders. Jasmine species also finds place in cosmetics and used for making perfumes and scents [8,9]. *Jasminum polyanthum* flower is used as herbal plant for diabetes mellitus. The dried flower extract has been used traditionally.

In the present study, the hydroalcoholic extract of dried flower of *Jasminum polyanthum* is assessed for hypoglycemic activity in streptozotocin (STZ)-induced diabetic male albino rats.

MATERIALS AND METHODS

Animals

Male wistar rats (150-180g) where procured from Mass Biotech,Chengalpet,TN laboratory. IAEC approved the protocol with Ref.No: 04/321/P0/Re/S/01/CPCSEA/dated 17/11/21 .

Chemicals
STZ and Glibenclamide where purchased from SRL chemicals, Mumbai
Plant source
The flower of *Jasminum polyanthum*(JP) was collected from Villupurm, Tamilnadu, and authenticated by Plant Anatomy Research Centre with reg no PARC/2022/4712. It was shade dried. The dried flower was powdered in a blender and it was extracted using soxhlet and hydroalcoholic solvent was used (80:20).

ANIMAL GROUPING
Experimental Design
Adult wistar male rats (150-180g) were divided into five groups each containing six rats.
Group-I: Control group treated with distilled water/p.o.
Group-II: STZ (40mg/kg /i.p) induced rats
Group-III: STZ+Glibenclamide (10mg/kg/p.o) STD
Group-IV: STZ+ *Jasminum polyanthum* extract (200mg/kg/p.o)
Group-IV: STZ+ *Jasminum polyanthum* extract (400mg/kg/p.o)

Induction of Diabetes
STZ was stored at 4-8^{o}C. It was dissolved in citrate buffer pH 7.4 and prepared for immediate use, wistar rats were fasted overnight STZ was given in dosage of 40mg/kg b.w/i.p. Rats were checked for diabetic on the 3rd day. Rats showing glucose levels of 250mg/dl and above were considered diabetic, were included for the study.

Study parameters
All groups were observed for changes in body weight, food intake, water intake and blood glucose level on 0th, 7th, 14th, 21st and 28th day. On 28th day blood was collected and subjected to lipid profile test. Pancreas was collected, homogenized and antioxidant levels were estimated. Histopathology was done on pancreas.

Estimation of Blood Glucose Levels
The blood glucose levels were estimated using Accu-check Active glucometer. In the tail vein small cut was done, blood was placed on the test strip blood glucose level (mg/dl) displayed was noted.

Biochemical studies
The blood serum was used to estimate Total cholesterol, HDL cholesterol, LDL cholesterol, VLDL cholesterol, Triglycerides.

Antioxidant analysis

Preparation of pancreas homogenate

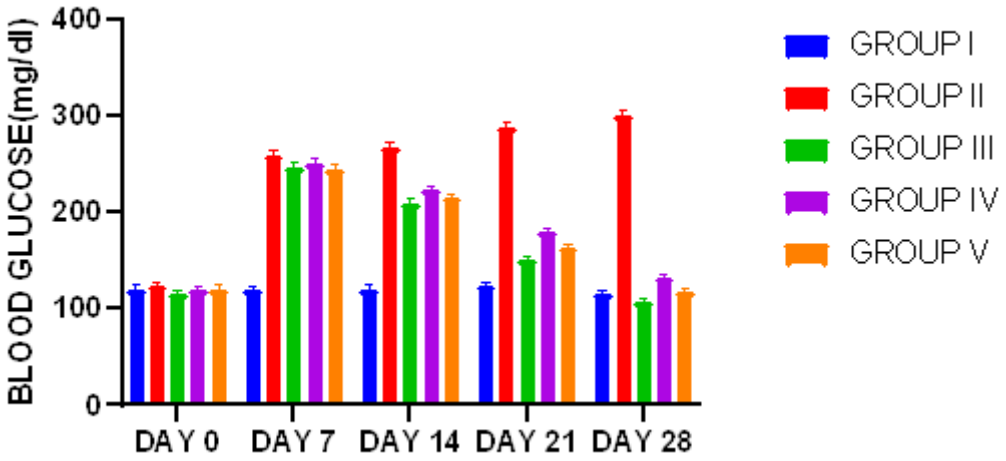
The pancreas were excised out washed in ice cold normal saline, homogenized in tris-HCL (0.1M pH 7.4) using an ice chilled glass homogenizer at 900rpm. The suspended mixture was centrifuged for 10min at 4^{o}C in a refrigerated centrifuge. The supernatant was used for the assay of antioxidants.

Histopathology analysis
Pancreatic tissue was suspended in 10% formalin and histopathological studies were done.

Statistical Analysis of Data
Experimental data were expressed as Mean $\pm$ SEM, significant reduction were calculated using ANOVA followed by Dunnet's test

Results
Our study was carried out to evaluate the anti-diabetic effect of *Jasminum polyanthum* flower using hydroalcoholic extract in STZ-induced diabetic wistar rats.
Food intake
Food intake of STZ group significantly ($p<0.0001$) increased when compared with control group. The JPH at oral dose 200mg showed significant ($p<0.01$) increase and 400mg/kg showed non-significant increase on 28th day when compared with STD group.
Water intake
Water intake of STZ group significantly ($p<0.0001$) increased when compared with control group. The JPH at oral dose 200mg and 400mg/kg showed non-significant increase on 28th day when compared with STD group.
Blood Glucose level
Blood glucose level of STZ group significantly ($p<0.0001$) increased when compared with control group. The JPH at oral dose 200mg showed significant ($p<0.001$) decrease and 400mg/kg showed non-significant decrease on 28th day when compared with STD group.
The blood glucose levels of all groups with Mean $\pm$ SEM, was compared together and differences are shown in Graph 1

Graph 1: Mean values of blood glucose levels of the five groups

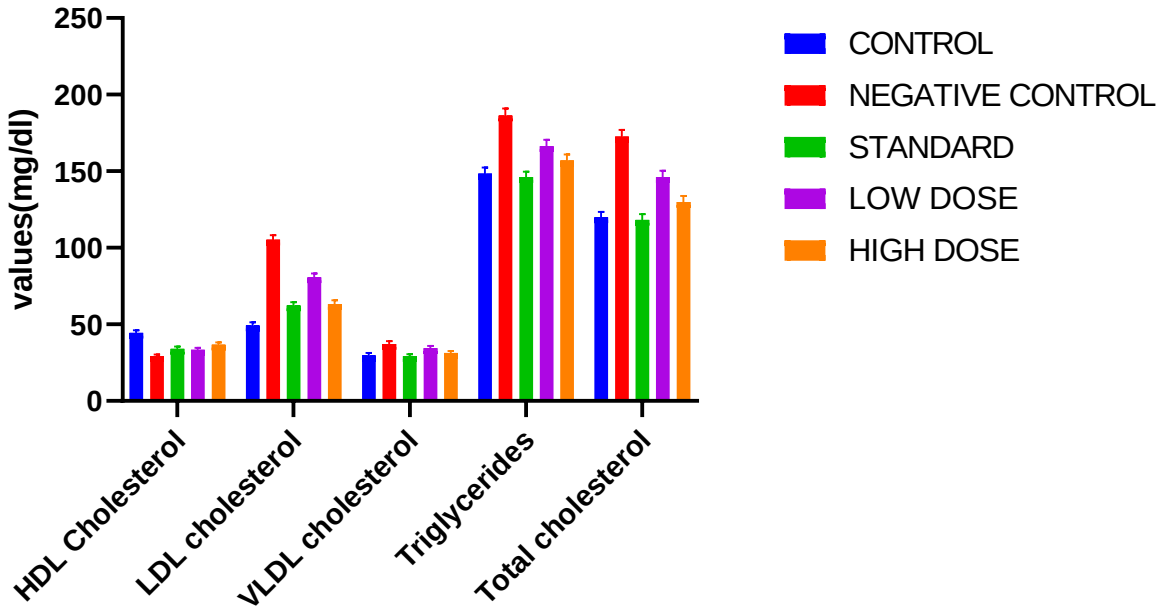


Graph 1 represents the blood glucose level of rats by comparing control with negative control and STD with low and high dose of JPH extract.

Lipid profile:

Blood serum was examined for lipid profile, HDL cholesterol of STZ group was significantly ($p<0.001$) decreased and TC,TG,VLDL,LDL showed significant ($p<0.0001$) increase when compared with control group . The JPH extract at oral dose (200mg and 400mg/kg) in HDL cholesterol showed non significantly increase and TC,TG,VLDL,LDL shows significant ($p<0.01$)decrease on 28th day when compared with STD group.

Graph 2

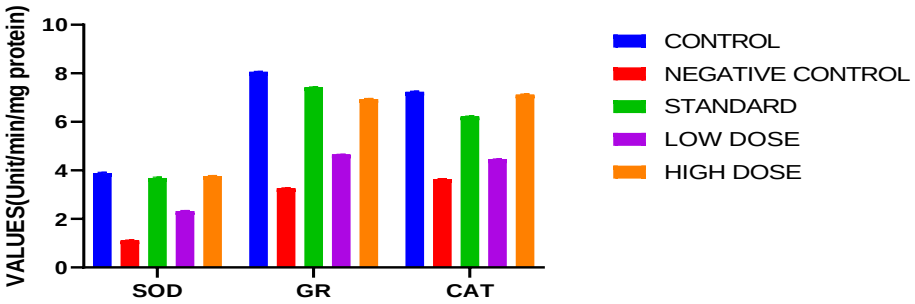


Graph 2 represents the lipid profile of blood serum of rats by comparing control with negative control and STD with low and high dose of JPH extract.

Effect of JPH flower extract on Antioxidant in STZ induced diabetic rats

Supernatant of pancreatic cells of STZ group significantly ($p<0.0001$) decreased when compared with control group. The JPH at oral dose 200mg showed significantly ($p<0.001$) increased and 400mg/kg showed non significant increase on 28th day when compared with STD group.

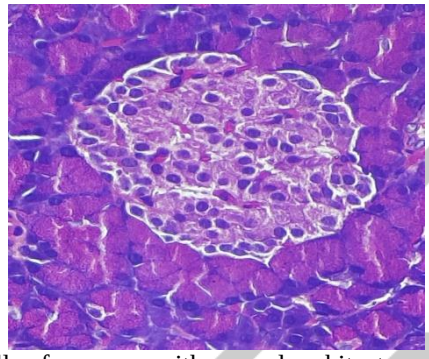
GRAPH 3



Graph 3 represents the antioxidant levels of pancreatic cells by comparing control with negative control and STD with low and high dose of JPH extract.

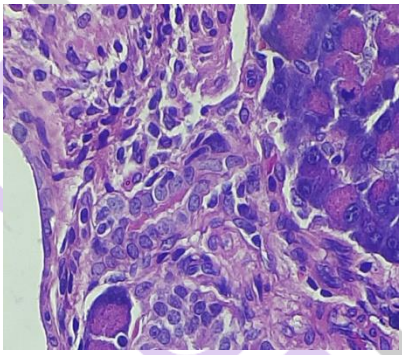
HISTOPATHOLOGY ANALYSIS

FIG 1:CONTROL



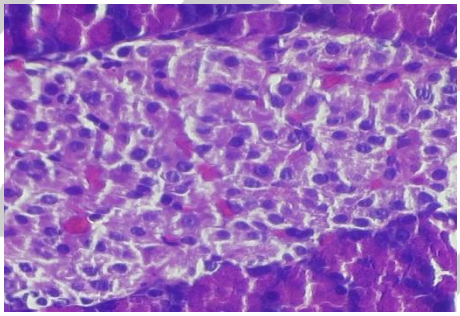
Cells of pancreas with normal architecture and proportion.

FIG 2: NEGATIVE CONTROL



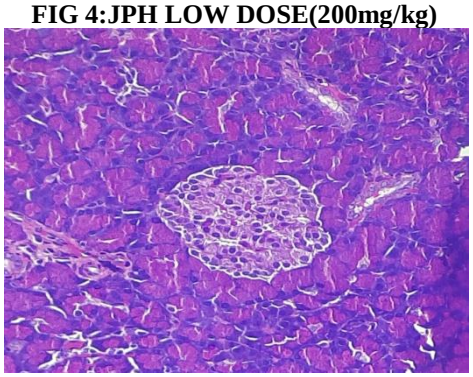
Exo and endocrine components and islets β-cells are totally damaged.

FIG 3:STANDARD GROUP



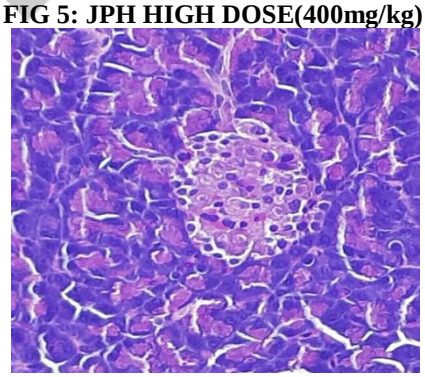
Evidence of cellular regeneration among the islets of Langerhans is observed

FIG 4:JPH LOW DOSE(200mg/kg)



Mild cellular regeneration among the islets of Langerhans

FIG 5: JPH HIGH DOSE(400mg/kg)



Marked cellular regeneration among the β-cells in islets of Langerhans.

DISCUSSION

Plants have been used as source of drugs for the treatment of diabetes mellitus in developing countries where the cost of conventional medicine represents a burden to the population. Many species have been reported for antidiabetic activity. So we have undertaken a study on *Jasminum polyanthum* for evaluation of its antidiabetic property along with its antioxidant potential.

Streptozotocin is the most commonly employed agent for the induction of experimental diabetic animal models of human insulin dependent diabetes mellitus. There is an increasing evidence that streptozotocin causes diabetes by rapid depletion of β-cells, by DNA alkylation and accumulation of cytotoxic free radicals that is suggested to result from initial islet inflammation, followed by infiltration of activated macrophages and lymphocytes in the inflammatory focus.

Standard drug Glibenclamide treatment brought down the blood glucose levels from the first day of the treatment. JPH 200mg and 400mg treatment produces significant reduction in blood glucose level from 7th day of treatment and a steady decrease was observed upto 28th day.

In Lipid profile, an elevated serum total cholesterol, triglycerides, LDL, VLDL and reduced HDL was observed in STZ-induced diabetic rats. The Glibenclamide treated as well as JPH 200mg and 400mg treated rats increased in HDL and reduction in TC,TG,LDL,VLDL .

The enzymatic antioxidant defence mechanism contains various forms of Superoxide dismutase, Catalase, Glutathione reductase. A marked decrease in all these was observed in STZ diabetic rats. Glibenclamide,JPH 200mg and 400mg showed a marked increase of the antioxidant enzyme level.

Histopathology studies was carried out in all five groups. Control group showed normal pancreatic cellular arrangement. STZ induced group shows complete destruction of pancreatic islet cells. Glibenclamide, JPH extract 200 and 400mg treated rats shows regeneration of pancreatic β cells.

Based on the above results and observations, we can infer that the flower of *Jasminum polyanthum* will be a good alternative and supportive treatment for diabetes mellitus, as the plant offers effective protection against free radicals which may be a cure for the diabetic complications.

CONFLICT OF INTEREST: NO CONFLICT OF INTEREST

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