

Antidiabetic activities of leaves extracts of *Justicia adhatoda* L. (Malabar nut) in rats

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(Received: 09 August 2023; Revised: 05 September 2023; Accepted: 27 September 2023; Published: 15 October 2023)

(Published by Research Trend)

ABSTRACT: *Justicia adhatoda* has been used for the treatment of various diseases and disorders. It is a primary medicinal plant for the respiratory tract ailments in the treatment of cough, bronchitis, asthma and symptoms of common cold. The Supercritical fluid extract of *Justicia adhatoda* in Group V (49.05%) and Group VII (47.95%) higher doses exhibited excellent antidiabetic property in albino mice.

Keywords: *Justicia adhatoda*, diabetes mellitus, blood glucose, supercritical fluid extraction, albino mice.

INTRODUCTION

Diabetes mellitus is a group of syndromes characterized by hyperglycaemia, altered metabolism of lipids, carbohydrates and proteins (Ahmad *et al.*, 2000). About 90% of diabetic patients are non-insulin-dependent diabetes mellitus (NIDDM), insulin resistance plays a key role in the development of the disease (Fuller *et al.*, 1980; Leng *et al.*, 2004). Chronic hyperglycaemia causes glycation of protein that in turn leads to secondary complications effecting the eyes, kidneys, nerves and arteries (Hirsch *et al.*, 2000). These complications can be prevented, delayed or decreased by maintaining blood glucose values close to normal. According to WHO, over 150 million people suffer from diabetes worldwide and this figure is likely to increase to 300 million or more by the year 2025 (Kim *et al.*, 2006). It is an increasing public health problem, especially in developing countries, where adequate treatment is often expensive or unavailable (WHO, 1980).

Justicia adhatoda commonly known as Malbar Nut or Bhiker have been used in medicine for more than 2000 years. It is commonly found in our country and well recognized in the native systems of medicine for its useful properties, predominantly in bronchitis and it's all parts are used widely for handling cold, whooping-cough, cough, asthma and chronic bronchitis (Singh *et al.*, 2009 and Ilango *et al.*, 2009).

Justicia adhatoda belongs to family Acanthaceae, subclass Asteridae and specie *Adhatoda* (Stewart, 1972). The leaf juice is shown to cure diabetes diarrhea, dysentery and liver relevant disorders. Two major alkaloids of *Justicia adhatoda* are vasicine and vasicinone formed by the oxidation of vasicine at C-8 position and possess interesting biological activities including antihyperglycaemic effects reported by different authors.

There is a growing interest in herbal remedies due to the side effects associated with the therapeutic agents (oral hypoglycemic agents and insulin for the treatment of diabetes mellitus). Many traditional folk medicinal and herbal extracts have been used for the treatment of diabetes mellitus, most of them have shown good effects but some exert only little or no effect on glycemic control in experimental studies (Bailey and Day 1989).

Therefore, the purpose of this study was to assess the possible effects of leaves extracts of *Justicia adhatoda* on diabetes related hematological parameters such as blood glucose levels in diabetic rats.

MATERIALS AND METHODS

A. Acute toxicity studies

The acute toxicity studies of *Justicia adhatoda* (JA) extract was performed using albino mice. The doses were fixed as per Organization for Economic Co-

operation and Development (OECD) guideline No.423 and adopted CPCSEA protocol. The toxicological effects were assessed on the basis of mortality and behavioural changes.

B. Preparation of extracts

The obtained *Justicia adhatoda* leaf (JAL) extract was dissolved in tween -80 (0.1% w/v)

C. Anti-diabetic activity

The rats (3 months old) weighing between 250 to 300 g of either sex and fasted for 24 hours. were taken for the experiment. Animals were divided into six groups (No. of rats in each group = 5). All groups rats were made diabetic excluding group I by injecting streptozotocin (STZ) (Sigma, St. Louis, Mo., USA) with a dose of 55 mg.kg⁻¹ (i.p), body weight is chilled citrate buffer (pH 4.5), after 8 hours, the rats showing blood glucose level of 250–350 mg.dl⁻¹ were considered as diabetic were employed in the study. The study was carried out following the guidelines of principles of laboratory animal care.

Group I: Served as solvent control

Group II: Served as diabetic control (STZ-induced)

Group III: Received insulin (0.6U /kg, sc.)

Group IV: Received JAL-SFE (150 mg/kg, p.o)

Group V: Received JAL-SFE (300 mg/kg, p.o)

Group VI: Received JAL-SFE Fraction (150 mg/kg, p.o)

Group VII: Received JAL-SFE Fraction (300 mg/kg, p.o)

All the test samples were administered daily and treatment period for all groups were two weeks on the

0–week, 1st, 2nd and 3rd weeks, the animals were tested for 8 hour and blood samples were drawn by orbital sinus puncture under mild anaesthesia. The blood samples were collected in Eppendorf's tube that contained 50 µL of EDTA (anticoagulant). The determination of serum glucose was performed by enzymatic method (GOD/POD-method-Beacon-Diagnostic Pvt Limited, India). Statistical Analysis Statistical analysis of data results was expressed as mean ±SE(m). and the data obtained was analysed by 'One-way ANOVA' followed by 'Dunnett's multiple comparison test'.

RESULTS AND DISCUSSIONS

The present investigation was focused on to screening of antidiabetic activity of *Justicia adhatoda* leaves ethanolic-extract (JAL-SFE) and its fractions (JAL-SFE Fraction). The result of the present study demonstrates the efficiency JAL ethanolic extract and fraction. Ethanolic extract of *Justicia adhatoda* is lowering the serum glucose level in STZ induced diabetic rat models.

The secondary plant metabolites such as flavonoids and their underlying molecular mechanisms on glucose transporter, tyrosine kinase inhibitor further flavonoids improve the regeneration of Beta islets-cell of the pancreas's trough the regulation glucose metabolism and alkaloids may be responsible for antidiabetic activity. The SFE extract of *Justicia adhatoda* in Group V (49.05%) and Group VII (47.95%) higher doses exhibited excellent antidiabetic property at 3rd week (Table 1) and shown in Fig. 1.

Table 1: Antidiabetic activity of *Justicia adhatoda* leaves ethanolic extract and its fractions.

Treatment	0 week (mg.dl ⁻¹)	1 week (mg.dl ⁻¹)	Reduction (%)	2 weeks (mg.dl ⁻¹)	Reduction (%)	3 weeks (mg.dl ⁻¹)	Reduction (%)
Group -I	76.40 ± 1.96	79.20 ± 0.86	-3.66	79.60 ± 0.50	-4.18	80.20 ± 1.13	-4.97
Group-II	202.00 ± 9.69	257.60 ± 4.50	-27.50	274.40 ± 2.15	-35.8	312.60 ± 1.77	-54.75
Group-III	253.80 ± 1.74	186.20 ± 2.2	26.63	123.40 ± 1.07	50.13	117.00 ± 1.94	53.90*
Group-IV	257.00 ± 1.94	243.20 ± 1.06	5.36	152.80 ± 1.06	40.54	137.60 ± 1.02	46.45*
Group-V	254.00 ± 1.41	195.20 ± 1.85	23.14	129.60 ± 0.92	48.97	129.40 ± 1.36	49.05*
Group- VI	260.80 ± 0.37	202.00 ± 1.14	22.50	141.80 ± 0.80	45.6	137.80 ± 0.86	47.16*
Group-VII	259.00 ± 1.78	195.60 ± 2.15	24.47	135.20 ± 1.39	47.7	134.80 ± 1.01	47.95*

* One way ANOVA applied and Indicates difference from groups p < 0.0001 (Highly significant)
The values are represented as Mean ± SEM, n= 5 in each group.

Ahmad *et al.* (2019) found a great remarkable reduction in blood glucose levels (159.67 ± 23.45 to 129 ± 39.88 mg.dl⁻¹) in diabetic animals which were induced with methanolic extract of *Justicia adhatoda* leaves. The *Justicia adhatoda* flavonoids probably stimulate insulin release by binding to β-islets cells of specific site β cell KATP channel complex and inhibiting its activity. KATP channel inhibition causes cell membrane depolarization and the cascade of events leading to insulin secretion and future increasing plasma insulin levels.

The result of the present study suggested that *Justicia adhatoda* ethanolic extract and fraction of JAL-F illustrate significant antidiabetic activity (P<0.001HS). The extensive investigation has been carried out in antidiabetic activity of leaves of *Justicia adhatoda* of ethanolic extract and its isolated bioactive constituents' flavonoids (JAL) an STZ (55mg/kg, i.p) induced albino Swiss rats. The antidiabetic activity was measured by autoanalyzer GOD method.

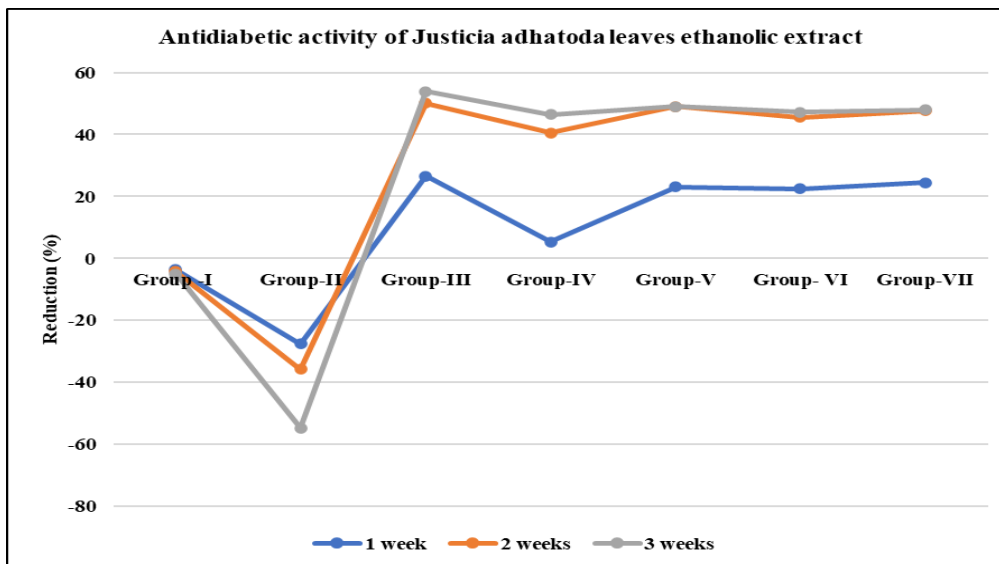


Fig. 1. Antidiabetic activity of *Justicia adhatoda* leaves (JAL) ethanolic extract and its fractions.

CONCLUSIONS

The investigation was focused on to screening of antidiabetic activity of *Justicia adhatoda* leaves (JAL) ethanolic-extract and its fractions (JAL-F). The result of the present study demonstrates the efficiency JAL ethanolic extract and fraction. Ethanolic extract of *Justicia adhatoda* is lowering the serum glucose level in STZ induced diabetic rat models. The SFE extract of *Justicia adhatoda* in Group V (49.05%) and Group VII (JBL-F 47.95%) higher doses exhibited excellent antidiabetic property at 3rd week. The Ethanolic extracts of *Justicia adhatoda* fractions and (JAL-F) treated groups showed better decrease in blood glucose level when compared with control group. Hence *Justicia adhatoda* extract and fraction are to be claimed as a good antidiabetic natural bioactive compound.

FUTURE SCOPE

The pharmacological activity such as anti-inflammatory and anti-cancer activity of supercritical fluid extract of *Justicia adhatoda* can be studied.

Acknowledgement. The authors are thankful to University of Agricultural Sciences, Raichur to conduct the experiment.

Conflict of interest. None.

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How to cite this article: Rachana, M. N., Sharanagouda Hiregoudar, Udaykumar Nidoni, Ramappa, K. T., Sushila Nadagouda and Nagaraj Naik (2023). Antidiabetic activities of leaves extracts of *Justicia adhatoda* L. (Malabar nut) in rats. *Biological Forum – An International Journal*, 15(10): 778-780.