

EFFECT OF ESSENTIAL OIL OF *CITRUS RETICULATA* ON BLOOD GLUCOSE AND LIPID PROFILE IN ALLOXAN INDUCED DIABETIC RATS

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ABSTRACT

In the present study, the essential oil of *Citrus reticulata* is investigated for anti-diabetic activity. The present study was planned to elucidate hypoglycemic effect of essential oil of *Citrus reticulata* and its interaction with glibenclamide in hyperglycemic rats. Alloxan induced hyperglycemic male wistar rats were orally administered, the essential oil alone and GLB 0.9mg/kg for 30 days. Blood glucose was estimated along with lipid levels on 31st day by Kit method. The essential oil of *Citrus reticulata* exhibited significant hypoglycemic and hypolipidemic effect in hyperglycemic rats.

Key words: *Citrus reticulata*, glibenclamide, hyperglycemia, hypolipidemia.

INTRODUCTION

Diabetes mellitus is a disease in which homeostasis of carbohydrate, protein and lipid metabolism is improperly regulated by hormone insulin resulting in elevation of fasting and postprandial blood glucose levels. [1]. The major chronic complications associated with diabetes include retinopathy, neuropathy, nephropathy, and atherosclerotic coronary artery disease and peripheral atherosclerotic vascular disease [2]. According to recent estimation, the global population is approaching the midst of a diabetes pandemic. By the year 2010 the total number of people worldwide with diabetes is predicted to reach 239 million [3]. Besides hyperglycemia, several other factors like hyperlipidemia and enhanced

oxidative stress play a major role in diabetic pathogenesis. Despite the great strides that have been made in the understanding and management of this disease, the graph of diabetes-related mortality is rising unabated. Although a numbers of synthetic drugs are available in the market diabetes and its related complications still remain uncontrolled. On the other hand, traditional medicinal plants have been used successfully since ancient times by physicians and laymen to treat diabetes and its related complications, presenting a stirring prospect for the expansion of an alternative way of treatment of diabetes [4, 5]. Herbal drugs are prescribed widely, even when their biologically active compounds are unknown, because of their effectiveness, lesser side-effects and relatively low cost

[6, 7]. Several plants have been investigated and reported to possess hypoglycemic activity eg. *Aegle marmelos* [8], *Allium cepa* [9], *Brassica oleracea* [10], *Semecarpus anacardium* [11] etc. Similarly *Citrus reticulata* is commonly known as santre. It is one of the essential oil bearing plant belonging to family Rutaceae. It is a perennial bushy tree with globose fruit. This plant finds its place in indigenous traditional medicinal system. The medicinal properties of this plant being mainly due to the essential oil produced by the secondary metabolism. In traditional medicine the essential oil from citrus fruit rind was advised for cutaneous complaints, hemiplegia, snake bite, fever loss of taste, chronic rheumatism, stomach ache, menorrhagia, splenomegaly, edema and cardiac diseases [12]

Paucity of scientific information regarding the effect of essential oil on blood glucose and lipid level, the present study was planned accordingly to investigate the effect of *Citrus reticulata* on alloxan induced hyperglycemic rats.

MATERIALS AND METHODS

Plant collection and oil extraction

Fresh mature fruits were obtained from the local market were identified and confirmed by the Botanist Mrs.R.Rashinwadkar and the samples were preserved at M.M.College Botany dept with voucher no. MMC47. The fruit rind was removed and pale yellow colored essential oil was obtained by hydrodistillation using Clevenger type apparatus.

Animals:

The complete course of the experiment was carried out using healthy male rats of wistar strain, reared and maintained at the animal

house of the institution. Rats were fed with commercial laboratory animal feed (Amrut lab) and water ad libitum. The rats weighing between 150-250 g were housed separately in groups with a distinct identity for about a week for acclimatization. All experimental protocols were prepared and performed based on ethical guidance of Institutional Animal Ethical Committee.

Chemicals

Alloxan monohydrate, a most widely used chemical diabetogen was procured from Loba chemie, Mumbai, India and other reagents used in the experiment were of analytical grade. Glibenclamide, a standard antidiabetic agent was purchased from Aventis Pharma. Ltd. Goa, India.

Antihyperglycaemic Studies- Induction of diabetes

Hyperglycemia was induced in overnight fasted adult Wistar strain albino rats weighing 150-250 g by a single intraperitoneal injection of freshly prepared alloxan monohydrate in normal saline (150 mg/kg body weight) in a volume 1 ml/kg body weight [13]. Hyperglycemia was confirmed by the elevated glucose level in plasma, determined at 48 h after injection. The rats found hyperglycemic were screened for the antihyperglycaemic study.

Experimental Design

Animals were divided into three groups of six rats each. Test group was administered with essential oil at dose of 200 mg/kg body weight by oral route. Standard and control animals were treated with standard drug glibenclamide at an oral dose of 1 mg/kg body weight and distilled water respectively. All doses were started 48 h after alloxan injection. The above treatments were given once daily for 30

days and on 31st day under ether anesthesia cardiac blood 2ml was collected for estimation of glucose and lipid profile. Standard kits (Beacon diagnostic) were used to estimate Fasting blood glucose total cholesterol triglycerides, HDL and LDL, VLDL were calculated.

Statistical analysis:

The results were analysed by using one way ANOVA followed by Dunnett's test, $p < 0.05$ was considered to be significant.

RESULTS

Hypoglycemic effect:

A month long chronic administration of essential oil produced significant hypoglycemic effect as compared to vehicle control group in hyperglycemic animals. (Table1)

Lipid profile:

In hyperglycemic animals essential oil favorably altered the plasma lipid profile by

Table1

Effect of <i>Citrus reticulata</i> essential oil in hyperglycemic rats		
Groups	Before treatment	After treatment
Control	383.3± 5.38	400 ±12.73
Standard(GLB0.9)	360.2 ±5.94	243.3±3 15.38**
Essential oil	374.7 ±4.75	169± 4.033**

ANOVA followed by Dunnett's test, ** $p < 0.01$

Table2:

Effect of <i>Citrus reticulata</i> essential oil on lipid profile in hyperglycemic rats						
Groups	Total Cholesterol	Triglyceride	HDL	LDL	VLDL	LDL/HDL
Control	163.1± 4.496	98.1± 1.515	12.17 ±0.945	129.7± 5.307	19.63 ±0.3029	10.92±0.8292
Standard (GLB0.9)	148± 8.729**	82.50± 1.408**	19.33± 1.022**	117.8 ±3.827**	16.5 ±0.2817**	6.162± 0.2842**
Essential	100.7±	49.33	35.17±	61.32	9.867	1.7853

significantly decreasing total cholesterol, LDL, LDL/HDL ratio and by significantly increasing HDL. (Table2)

DISCUSSION

Findings of the present study clearly indicate that treatment with essential oil of *Citrus reticulata* is effective in controlling hyperglycemia and favorably altering the blood lipid profile. It is very difficult to comment on the mechanism of hypoglycemic activity of essential oil, since the study was not designed accordingly. Biflavonoids, sterols, D-limonene, linalool, are present in *Citrus reticulata* and could be responsible for its hypoglycemic activity by virtue of their antioxidant property [14]. Antioxidants have been reported to exert beneficial effects on pancreatic β -cell function by preventing or delaying β -cell dysfunction due to glucose toxicity [15]. Previous research on this subject has shown that drugs containing tannins and sterols possess antidiabetic activity.

oil	2.533**	±1.282**	1.302**	±4.717**	±0.2565**	±0.1376**
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ANOVA followed by Dunnet's test, **p<0.01

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