
ANTIDIABETIC EFFECT OF *OCIMUM SANCTUM* IN STREPTOZOTICIN INDUCED DIABETIC ALBINO RATS**ALKA KULSHRESHTHA**

Abstract: Anti diabetic activity was detected in herbal extract of *Ocimum sanctum* (Family Labiatae), using streptozotocin (STZ) induced diabetic rat model. Extract at the dose of 500 mg/kg body weight given orally for 15 days, showed statistically significant reduction in blood glucose levels of treated rats as compared to their diabetic control ($P < 0.01$). Diabetic animals treated with herbal extract also showed significant increase in their body weight. So, we can conclude that in streptozotocin rat model aqueous extract of *Ocimum sanctum* leaves showed significant antidiabetic potential as judged from statistically significant decrease in blood glucose and increase in body weight.

Keywords: *Ocimum sanctum*, Streptozotocin, blood glucose, albino rat.

Introduction: Diabetes mellitus is a genetically determined disorder of the metabolism of carbohydrate, protein and fats associated with a relative or absolute insufficiency of insulin secretion and with various degrees of insulin resistance, in which the level of blood glucose is persistently raised above the normal range. This disease is heterogeneous in nature. Differences between various forms of the disease are expressed in terms of etiology and pathogenesis (genetic, environmental and immune factors), natural history and response to treatment. Diabetes therefore is not a single disease but a syndrome.

A currently available therapy for diabetes suffers from a number of serious adverse effects. Therefore there is a continuous requirement to develop new antidiabetic drugs. Diabetes is still posing a serious threat to the presently available management techniques. Plant based products have played a major role in the introduction of new therapeutic agents. India is very rich in having reserves of natural resources and history of traditional medicine (Grover and Vats, 2001). Considering the economic resources constraints and cheap cost of these plant products, antidiabetic activities should be scientifically evaluated in different herbs. Therefore the present investigation was carried to find out the antidiabetic potential of *Ocimum sanctum* as indicated by changes in body weight gain, blood glucose.

Ocimum sanctum has been used for thousands of years in Ayurveda for its diverse healing properties. Tulsi, the Queen of herbs, the legendary 'Incomparable one' of India, is one of the holiest and most cherished of the many healing and healthy giving herbs of the orient. (Pattanayak et al 2010) The sacred basil, tulsi, is renowned (Warrier 1995) for its religious and spiritual sanctity, as well as for its important role in the traditional Ayurvedic and Unani system of holistic health and herbal medicine of the East. It is mentioned by Charaka in the

Charaka Samhita; an Ayurvedic text. Tulsi is considered to be an adaptogen, balancing different process in the body, and helpful for adapting to stress. Marked by its strong aroma and astringent taste, it is regarded in Ayurveda as a kind of 'elixir of life' and believed to promote longevity. Tulsi extracts are used in Ayurvedic remedies for common colds, headaches, stomach disorders, inflammation, heart disease, various forms of poisoning and malaria. Traditionally, *O. sanctum* L. is taken in many forms, as herbal tea, dried powder or fresh leaf. For centuries, the dried leaves of Tulsi have been mixed with stored grains to repel insects. (Biswas & Biswas, 2005). *Ocimum sanctum* has been used for prevention and treatment of cancer (Bhattacharya and Bishayee 2013).

Material and Methods: Albino rats weighing 100 – 150 g were used in the present study. Before the start of the experiment, all the rats were given a period of acclimatization for 15 days. All the rats were given food and water *ad libitum*. Diabetes in albino rats was induced with the help of an intraperitoneal injection of streptozotocin at the dose of 50 mg/kg body weight. The appropriate doses were dissolved in 0.1 M citrate buffer (pH. 4.5) and injected i.p. within 15 minutes of dissolution in a vehicle volume of 0.4 ml. Normal control group was given citrate buffer only (0.4 ml). Diabetes was confirmed by the determination of fasting glucose concentration of the third day post administration of streptozotocin.

Rats were divided into the four groups of six animals each. Group I was given only distilled water daily and served as normal control. Group II consisted of STZ induced diabetic rats and served as diabetic control and were given distilled water only. Group III consisted of STZ induced diabetic rats and were treated orally with water extract of *Ocimum sanctum* leaves at the dose of 500 mg/kg body weight daily for 15 day, once a day. Group IV consisted of STZ induced diabetic rats and were given glibenclamide

(GBC) at the dose of 3 mg/kg body weight daily for 15 day, once a day.

After the termination of experiment (next day of 15th day treatment) body weight of rats were taken. There blood glucose level was measured with the help of glucometer, using strip method and blood was taken

out from the tip of the tail. Statistical analyses were done with help of Student's 't' test (Bruning and Kintz, 1977).

Result: The effect of the herbal drug on body weight and blood glucose levels in streptozotocin induced diabetic rats is shown in Table 1.

S.No.	Groups	BODY WEIGHT (g)		BLOOD GLUCOSE (mg/dl)		Difference in Blood Glucose	Percent increase (+) or decrease (-)
		Change in Body Weight	Percent increase (+) or decrease (-)	Before Treatment	After Treatment		
1	Normal Control	11.5(+)	9.50	89.66 ± 5.61	92.33 ± 3.14	2.61 (+)	2.39
2	Diabetic Control	8.3(-)	6.90	236.50 ± 8.59	253 ± 13.63	16.5(+)	39.02
3	Diabetic + <i>O.Sanctum</i>	6.17(+)	4.85	232 ± 15.63	172.33 ± 7.49*	59.67(-)	13.84
4	Diabetic + GBC	4.84 (+)	3.83	235.5 ± 7.49	181.16 ± 7.12*	54.34 (-)	12.79

Values are mean±SD; n=6 in each group. *P<0.01 (compared to diabetic control)

Body weight: The body was found to be increased in *Ocimum Sanctum* treated rats, when compared to their respective diabetic control group. Percent increase in body weight was 4.85% for *Ocimum Sanctum* and 3.83% for glibenclamide (P<0.01) while in diabetic control group body weight was found to be significantly low when compared to the normal control (Table 1)

Blood glucose: Blood glucose level of diabetic control group was found to be higher than normal control. Raised level of blood glucose in diabetic rats were declined sharply after oral feeding of aqueous extract of *Ocimum sanctum* and glibenclamide (P<.001) when compare with their diabetic control. Percent decline in blood glucose for *Ocimum sanctum* was 13.84% and for glibenclamide was 12.79%. It is evident from these results that reduction in blood glucose levels brought by *Ocimum sanctum* extract is quite comparable with reduction brought by Glibenclamide.

Discussion: Historical literature reveals that knowledge regarding diabetes existed since Brahmic period as this was mentioned in Ayurvedic text books – Sushruta samhita written in fourth and fifth centuries B.C (Dhanukar and Thatte, 1989). In this ancient text, two forms of diabetes were described: one genetically based and the other as a result of dietary indiscretion (Dhanukar and Thatte, 1989). Even the treatment in the Indian ancient

pharmacopoeia mentioned specific treatments for the two types including dietary modification, medicinal plant remedies and minerals. Moreover, the researches conducted over last several decades has shown plant and plant based therapies have a potential to control and treat diabetes (Oliver Bever and Zahnd, 1979; Bailey and Day 1989; Ivorra et al, 1989; Marles and Farnsworth 1995) and its complications (Grover et al, 2001). Role of Indian medicinal plants as antidiabetic has also been reviewed by Grover et al (2002). For testing antidiabetic potential of plants, STZ induced hyperglycemia in rodents is considered to be a good preliminary screening model (Ivorra et al, 1989) and it widely used.

Defects in carbohydrate metabolizing machinery and consistent efforts of the physiological systems to correct the imbalance in carbohydrate metabolism place an over exertion on the endocrine system, which leads to the deterioration of endocrine control. Continuing deterioration of endocrine control exacerbates the metabolic disturbances and leads primarily to hyperglycemia. This presents a moving therapeutic target that requires a range of different agents to address the different features of the disease at different stages of its natural history. Although biomedical science has unraveled substantially the pathologically process involved in causing/fostering diabetes, and has designed therapeutic agents with a

range of action to fight hyperglycemia, the efficacy of these therapeutic agents act only on part of the pathogenic process and only to a partial extent. This may be the reason that even after so much advancement in understanding the disease process and availability of a wide range of therapeutic agents, the disease is still progressing.

In the present study STZ administration at a dosage of 50 mg/kg (Rafiullah et al, 2006) to normal rats significantly elevated the blood glucose levels. The results indicate that aqueous extract of *Ocimum sanctum* leaves decrease the blood glucose levels significantly. Administration of STZ selectively destroys the B-cells of islets of Langerhans (Elsner et al, 2000). The hypoglycemic action of the extract in diabetic rats may be possible through the insulinomimetic action or by other mechanism such

as stimulation of glucose uptake by peripheral tissues, inhibition of endogenous glucose uptake by peripheral tissues, inhibition of endogenous glucose production or activation of gluconeogenesis in liver and muscles as similar mechanisms have been reported for plant extracts with antidiabetic activity (Burcelain et al, 1995). Further investigations are required to determine the exact cellular and molecular mechanisms of the antidiabetic extracts. As *Ocimum sanctum* is widely distributed throughout the country and leaves have also been shown to have an antihyperglycemic effect, the findings of present study suggest that consumption of *Ocimum sanctum* leaves should be promoted in higher proportion in diabetic patients as well as those prone to getting diabetes.

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