

**EVALUATION OF HYPERGLYCEMIC AND HYPERLIPIDEMIC MITIGATING IMPACT OF
HIBISCUS ROSA SINENSIS (GUDHAL) FLOWER IN TYPE II DIABETES MELLITUS
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ABSTRACT

Background: Diabetes mellitus is possibly the world's largest growing metabolic disease. The International Diabetes Federation (IDF) estimates the total number of people in India with diabetes to be around 50.8 million in 2010, rising to 87.0 million by 2030. Currently, a challenge is to identify such healthy foods that remain in the realms of obscurity and to establish them as functional foods to prevent the progression of metabolic complications. *Hibiscus rosa sinensis* is indigenous to India and is used extensively in the traditional system of medicine to treat diabetes and other myriad ailments. Therefore, the objective of the study was undertaken to evaluate the effect of *Hibiscus rosa sinensis* flower powder on type II diabetic subjects.


Methods: Type II diabetic subjects were selected from main campus of Banasthali University, Newai Rajasthan and divided into experimental and control groups (Age group: 30-60 years). *Hibiscus rosa sinensis* 2g flower powder was incorporated in baked mathri and administered to the experimental group daily for 60 days. Biochemical evaluations of blood sample of subjects were done.

Results: The present study indicates that *Hibiscus rosa sinensis* flower powder showed a significant effect on blood glucose and lipid parameters.

Conclusion: *Hibiscus rosa sinensis* purport to alleviate the symptoms of diabetes in a natural manner with a low adverse effect on health and inexpensive than other hypoglycemic drugs.

Keywords: *Hibiscus rosa sinensis*, Blood glucose parameters, Lipid parameters, metabolic complications.

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INTRODUCTION

Diabetes Mellitus is a group of metabolic disease characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action or both. The abnormalities in carbohydrate, fat and protein metabolism that are found in diabetes mellitus are due to deficient action of insulin on target tissue (Craig *et al.*, 2009). Diabetes mellitus is a relatively common disease with major public health implication (WHO, 2010). The prevalence of diabetes is rapidly rising all over the globe at an alarming rate (Huizinga and Rothman, 2006). Over the past 30 year, the status of diabetes has changed from being considered as a mild disorder of the elderly to one of the major causes of morbidity and mortality more common form of diabetes, namely type II diabetes, which accounts for more than 90 per cent of all diabetes cases. Nowhere is the diabetes epidemic more pronounced than in India as the World Health Organization (WHO) reports show that 32 million people had diabetes in the year 2000 (Mohan *et al.*, 2008). The International Diabetes Federation (IDF) estimates the total number of diabetic subjects to be around 40.9 million in India and this is further set to rise to 69.9 million by the year 2025 (Sicree *et al.*, 2006).

Hyperglycemia, the common characteristic of both type 1 diabetes mellitus (IDDM) and type 2 diabetes mellitus (NIDDM), have the potential to cause serious complications due to its insidious and chronic nature (Papatheodorou *et al.*, 2015). Diabetes Mellitus associated dyslipidemia is a major factor responsible for the development of macro vascular complications (Singh *et al.*, 2015). Traditional medicine (herbal) is used for the treatment of diabetes in developing countries where the cost of conventional medicines is a burden to the population (Saravanan *et al.*, 2008). Many indigenous Indian medicinal plants have been found to be useful to successfully manage diabetes. One of the great advantages of medicinal plants is that these are readily available and have very low side effects (Arumugam *et al.*, 2013). Hibiscus has medicinal properties and takes part as a primary ingredient in many herbal teas. One species of Hibiscus, known as Kenaf (*Hibiscus cannabinus*), is extensively used in paper making. It has a use as antidote to poisoning with chemicals (acid, alkali and pesticides) and venomous mushrooms. *Hibiscus rosa sinensis* has a resistance to fungal pathogens. Its essential oil has antifungal activity and one of its constituents was found to be active against human cancer cell lines in several stages of cellular division (Moujir *et al.*, 2007). The aqueous ethanolic extract of aerial parts of *Hibiscus rosa sinensis* was reported for its use in constipation and diarrhea (Gilani *et al.*, 2005). The flowers of *H. sinensis* plant possess anti-infertility activity, antioxidant activity (Anusha *et al.*, 2011) and anti-depressant activity (Pallavi *et al.*, 2012). Flowers of the plant are used in diabetes, epilepsy, bronchial catarrh and leprosy (Pekamwar *et al.*, 2013). Therefore, it is reasonable to expect a verity of plant compounds with specific as well as general antimicrobial activity and antibacterial potential. Traditionally the flowers can be used as anti-asthmatic agents (Sikarwar *et al* 2011; Zhao *et al.*, 2010). Many chemical constituents such as cyanidin, quercetin, hentriacontane, calcium oxalate, thiamine, riboflavin, niacin and ascorbic acids have been isolated from this plant and several studies which reveal the presence of such compounds with antimicrobial properties in various plant parts (Sorachai *et al.*, 2011). Hence in the present study an attempt has been done in order to investigate about the hypoglycemic and hypolipidemic effect of *Hibiscus rosa sinensis* flower powder in type II diabetes mellitus.

MATERIALS AND METHODS

Collection of Plant material

The flower powder of *Hibiscus rosa-sinensis* was collected from Patanjali Herbal Garden and Agro Research Department Haridwar, Uttarakhand

Chemicals

All chemicals and solvents were of analytical grade. Sigma Chemical Co. (Saint Louis, MO, USA), HiMedia Labs. (L.B.S Marg Mumbai) and other chemicals and solvents were purchased from Merck chemicals Mumbai, India.

Experimental design

All the diabetic subjects were randomly divided into two groups i.e. Experimental group (A) and Control group (B) with six subjects each. All subjects were between the age group 30-60 years, including both male as well as female. Fasting blood glucose levels as well as glycosuria were assessed to confirm the diabetic state. Only subjects with a fasting blood glucose level of at least 250 mg/dl and positive urine glucose were considered diabetic and used in the experimental group. They were fed with 2g flower powder of *Hibiscus rosa sinensis* incorporated in baked mathri for 60 days.

Group A was supplemented with 2g *Hibiscus rosa sinensis* flower powder in the form of baked mathri for 60 days respectively. After 60 days biochemical evaluations of subjects were done. Approximately 5ml fasting blood sample was collected from each subject on day 0 and day 60 and was used for further evaluation. Blood glucose was measured with elegance glucometer (CT-X10, Convergent Technologies, Germany) at 0 day and 60 day after daily administration of flower powder of *Hibiscus rosa sinensis* incorporated in baked mathri.

Blood Glucose and Lipid profile

On day 60, blood was collected by glucometer. The values were expressed as mg/dl of blood with glucometer was assayed by the method of Gancedo and Gancedo (1971). Blood glucose level was estimated by GOD/ POD enzymatic method (Trinder, 1969). Glycosylated haemoglobin (HbA1c) was estimated by Ion Exchange Rasin Method (Nathan *et al.*, 2008). Total cholesterol was estimated by CHOD-PAP method (Meiattini *et al.*, 1978). HDL-cholesterol was estimated by PEG-CHOD-PAP method (Siedel *et al.*, 1983). Total triglyceride was estimated by Mc Gowan method (1983). LDL and VLDL were estimated by Friedewald equation (Friedewald *et al.*, 1972).

Statistical analysis

All the data were expressed as mean \pm SEM. Statistical analysis was carried using Student's t-test to analyze the significance between the groups.

RESULTS

This study was carried out to observe the hypoglycemic and hypolipidemic effect of *Hibiscus rosa sinensis* powder in type II diabetes mellitus subjects.

Effect of *Hibiscus rosa sinensis* flower on Fasting Blood Glucose and Post Prandial Blood Glucose Level

The result shows a significant decrease at both level ($p \leq 0.01$) and ($p \leq 0.05$) in the mean fasting blood glucose and post prandial blood glucose level. The calculated value of t is greater than the tabulated value, hypothesis is accepted. Hence the supplement is useful for diabetic patients.

Table 1. Effect of *Hibiscus rosa sinensis* flower on Fasting Blood Glucose Level and Post Prandial Blood Glucose Level

	Group	Pre intervention (Mean \pm SD) (mg/dl)	Post intervention (Mean \pm SD) (mg/dl)	Mean (Difference between pre and post intervention)	t test
Fasting Blood Glucose Level	A (Experimental)	147.8 \pm 43.54	111.6 \pm 35.32	-36.2	9.76**
	B (Control)	179.0 \pm 0.90	180.9 \pm 32.61	+1.9	0.833*
Post Prandial Glucose Level	A (Experimental)	184.6 \pm 81.86	126.5 \pm 34.14	-58.1	17.9**
	B (Control)	252.8 \pm 0.76	253.6 \pm 0.45	+0.8	0.10*

**Significant level ($p \leq 0.01$) and ($p \leq 0.05$) *Non-Significant

Effect of *Hibiscus rosa sinensis* flower on Glycosylated Hb Level

The result shows a significant decrease at both level ($p \leq 0.01$) and ($p \leq 0.05$) in the mean glycosylated Hb level. The calculated value of t is greater than the tabulated value, hypothesis is accepted. Hence the supplement is useful for diabetic patients.

Table 2. Effect of *Hibiscus rosa sinensis* flower on Glycosylated Hb Level

Group	Pre intervention (Mean \pm SD) (mg/dl)	Post intervention (Mean \pm SD) (mg/dl)	Mean (Difference between pre and post intervention)	Paired t test
A	11.21 \pm 0.52	10.05 \pm 0.59	-1.16	1.88**
B	179.0 \pm 0.90	180.9 \pm 32.61	+1.9	0.833*

**Significant level ($p \leq 0.01$) and ($p \leq 0.05$) *Non-Significant

Effect of *Hibiscus rosa sinensis* flower on Total Cholesterol and Triglyceride Level

The result shows a significant decrease at both level ($p \leq 0.01$) and ($p \leq 0.05$) in the mean total cholesterol and triglyceride level. The calculated value of t is greater than the tabulated value, hypothesis is accepted. Hence the supplement is useful for diabetic patients.

Table 3. Effect of *Hibiscus rosa sinensis* flower on Total Cholesterol Level

	Group	Pre intervention (Mean \pm SD) (mg/dl)	Post intervention (Mean \pm SD) (mg/dl)	Mean (Difference between pre and post intervention)	Paired t test
Total Cholesterol Level	A	226.46 \pm 7.72	221.30 \pm 8.57	-5.16	3.3**
	B	219.9 \pm 15.56	221.6 \pm 9.52	+1.7	0.10*
Triglyceride Level	A	212.06 \pm 20.19	202.89 \pm 21.87	-9.17	13.2**
	B	149.1 \pm 10.08	151.3 \pm 5.81	+2.2	0.10*

**Significant level ($p \leq 0.01$) and ($p \leq 0.05$) *Non-Significant

Effect of *Hibiscus rosa sinensis* flower on Total HDL-Cholesterol Level

The result shows no change at both level ($p \leq 0.01$) and ($p \leq 0.05$) in the mean total HDL cholesterol level. The calculated value of t is less than the tabulated value, hypothesis is rejected. Hence the supplement didn't get affected and stabilize the HDL-C in the diabetic patients.

Table 4. Effect of *Hibiscus rosa sinensis* flower on Total HDL-Cholesterol Level

Group	Pre intervention (Mean±SD) (mg/dl)	Post intervention (Mean±SD) (mg/dl)	Mean (Difference between pre and post intervention)	Paired t test
A	54.19±1.23	55.43±0.85	+1.24	1.07*
B	46.7±5.84	46.1±4.68	-0.6	0.11*

**Significant level ($p \leq 0.01$) and ($p \leq 0.05$)

*Non-Significant

Effect of *Hibiscus rosa sinensis* flower on Total LDL and Total VLDL Cholesterol Level

The result shows a significant decrease at both level ($p \leq 0.01$) and ($p \leq 0.05$) in the mean total LDL and VLDL cholesterol level. The calculated value of t is greater than the tabulated value, hypothesis is accepted. Hence the supplement is useful for diabetic patients.

Table 5. Effect of *Hibiscus rosa sinensis* flower on Total LDL and Total VLDL Cholesterol Level

	Group	Pre intervention (Mean±SD) (mg/dl)	Post intervention (Mean±SD) (mg/dl)	Mean (Difference between pre and post intervention)	Paired t test
Total LDL Level	A	129.83±7.87	123.98±9.54	-5.8	6.5**
	B	144.3±9.62	145.1±5.30	+0.8	0.09*
Total VLDL Level	A	42.47±4.36	40.76±4.48	-1.71	2.83**
	B	26.8±5.22	24.9±5.36	+6.8	0.09*

**Significant level ($p \leq 0.01$) and ($p \leq 0.05$)

*Non-Significant

DISCUSSION

Hibiscus rosa sinensis possess many properties and this plant may procured at large scale for providing herbal alternative to many diseases. Herbal drugs are prescribed widely because of their effectiveness, less side effects and relatively low cost. Therefore, investigation on such agents from traditional medicinal plants has become more important. *Hibiscus rosa sinensis* from the same genus has antidiabetic effect (Mozaffari et al., 2009). Keeping in view of traditional uses, the powder of *Hibiscus rosa sinensis* flower was analyzed for its antidiabetic and hypolipidemic activities. Significant reduction of blood glucose levels were observed in diabetic subjects treated with *Hibiscus rosa sinensis* flower powder incorporated in baked mathri. The most commonly observed lipid abnormalities in diabetes are hyper triglyceridemia and hypercholesterolemia (Shepherd et al., 2005). The results were similar to the study of Sachdeva and Khemani (2003) in which effect of *Hibiscus rosa sinensis* Linn. Ethanol flower extract on blood glucose and lipid profile in streptozotocin induced diabetes in rats were analyzed. A comparable hypoglycemic effect was evidenced from the data obtained after 7 and 21 days of oral administration of the extract and glibenclamide. Maximal diminution in blood glucose (41–46%) and insulin level (14%) was noticed after 21 days. The extract lowered the total cholesterol and serum triglycerides by 22 and 30%, respectively. The increase in HDL-cholesterol was much higher (12%) under the influence of the extract as compared to that of glibenclamide (1%). The results were also similar to the study of Basha and Subbarao (2015) conducted on antidiabetic, hypolipidemic and histopathological studies of ethanolic leaves extract of *Hibiscus rosa sinensis* in alloxan mono hydrate induced diabetic rats. Results indicated that *Hibiscus rosa sinensis* leaves extract has significant antidiabetic effects. The extracts also showed improvement in parameters like lipid profile body weight and redeployment of organs to normal stage. Gossain et al (2010) and Lee et al (2009) have shown lipid lowering activity of *Hibiscus rosa sinensis* flower extract in diabetic rats. However, they have used higher doses. The lipid lowering effect of extract of *Hibiscus rosa sinensis* in our study have a useful effect which avoids the complication of diabetes.

CONCLUSION

From this study, we can conclude that *Hibiscus rosa sinensis* flower powder supplementation decreased fasting and post prandial blood glucose level, glycosylated hemoglobin, total cholesterol, total triglyceride, LDL-C, VLDL-C and there was no significant effect on HDL-C parameter due to short period of supplementation. *Hibiscus rosa sinensis* has a beneficial role in diabetes having no ill effects on human health, easily available. Hence, it may be a safe and better alternative available over other agents in diabetes associated dyslipidemia and can be further used as a dietary supplement.

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