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Effect of Tulsi (*Ocimum sanctum* Linn) on clinical and biochemical parameters of metabolic syndrome

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Abstract

Metabolic syndrome can be defined as a set of symptoms, associated with a risk of coronary artery disease, hypertension, hyperlipidemia, hyperglycemia and obesity. Eugenol is a phenolic compound and major constituent of essential oils extracted from different parts of Tulsi plant. Its therapeutic use has been established on the basis of several pharmacological studies related with hyperglycemia, hypertension and dyslipidemia. To investigate the effect of Tulsi on clinical and biochemical parameters of metabolic syndrome. Hundred patients randomly selected for this study, further categorized in 2 groups, control group and study group. Patients were asked to take 5ml of Tulsi extract two times a day for three months. Baseline parameters were taken for every patient i.e. BMI, W/H Ratio fasting blood sugar, blood pressure, HbA_1c, lipid profile. Biochemical and anthropometric data were also recorded at the end of the study. On comparing control and study population for effect of Tulsi therapy, an improving trend was observed in study group. BMI (27.00 ± 3.23 to 27.10 ± 8.64 kg/m^2, p<0.9), SBP (151.30 ± 8.48 to 138.68 ± 9.84 mmHg, p<0.001), DBP (95.76 ± 3.63 to 87.12 ± 8.81 mmHg, p<0.001), glycemic control – FBS (209.26 ± 40.15 to 155.28 ± 20.70 mg/dl, p<0.001), HbA_1c (8.82 ± 1.25 to $7.34\pm0.89\%$, p<0.001). Lipid profile–total cholesterol (244.04 ± 26.30 to 209.28 ± 29.03mg/dl, p<0.001), triglyceride (176.48 ± 16.75 to 138.32 ± 15.17mg/dl, p<0.001), HDL (33.58 ± 3.47 to 39.36 ± 4.25mg/dl, p<0.001), LDL (174.9 ± 26.82 to 142.11 ± 27.50mg/dl, p<0.001), VLDL (35.37 ± 3.84 to 27.66 ± 3.03mg/dl, p<0.001). In metabolic syndrome, Tulsi therapy significantly reduces blood glucose, blood pressure and lipid profile. It shows the therapeutic effect of Tulsi and it may be used as an adjunct with diet and drugs in management of metabolic syndrome.

1. Introduction

Since the time of Charaka and Susruta many herbal medicines in different oral formulations have been recommended for metabolic syndrome. When several features of the insulin resistance syndrome cluster together (obesity, hyperglycemia, hypertension, dyslipidemia and accelerated cardiovascular disease) this has been described as the metabolic syndrome. Although there is not perfect concordance between the insulin resistance syndrome and metabolic syndrome, for practical purposes, these terms are often used interchangeably [1].Recently, the World Health Organization has recommended, especially in developing countries, the invitation of programmes designed to use medicinal plants more effectively in the traditional healthcare

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system [2]. In last few decades many studies have been carried out by Indian Scientists and Researchers to suggest the role of essential oils and eugenol (Tulsi extract) in the therapeutic potential of Tulsi [3,4]. Different parts of the Tulsi have been recommended for antidiabetic, antihypertensive adaptogenic, antilipidemic and cardio protective properties. Eugenol (1-hydroxy-2-methoxy-4-allylbenzene), the active constituent present in Ocimum S anctum Linn, has been found to be largely responsible for the therapeutic potential of Tulsi [5].

Current drugs used for diabetes therapy are not free from side effects and do not restore normal glucose homeostasis. Moreover, providing modern medicinal healthcare across the world, especially in developing countries, is still a far reaching goal due to economic constraints. Thus, it is necessary to look for new and if possible, more efficacious drugs and to make use of the vast reserves of phytotherapy for medicinal purpose [6]. The effectof supplementation of Tulsi leaf powder was studied on diabetic symptoms, anthropometrics parameters and blood pressure in non insulin dependent diabetes patients [7]. Hypoglycemic, hypolipidemic and antioxidant property of tulsi was studied on streptozotocin induced diabeteic rats [8]. Hence,it was planned to study the effect of Tulsi on clinical and biochemical parameters of metabolic syndrome.

2. Materials & Methods

Sources of Data: - For this study, hundred patients were randomly selected from the Diabetes Care & Research Centre of PBM Hospital. Approval was obtained by the Ethics committee, S.P.Medical College, Bikaner.

Place of Study:-This study was conducted in the Department of Physiology, S.P.Medical College, Bikaner.

Data Collection Procedure:-A detailed history of

each patient was obtained regarding the age, sex, year of diagnosis at diabetes, duration of diabetes, associated risk factors, family history and any associated illness. Age criteria in the study was 40 yrs and above. The life style was change in relation with diet, exercise, alcohol consumption and smoking in both the groups as all the patients were instructed to follow similar diet schedule along with restrictions for alcohol and smoking. The selected cases were divided into two groups randomly; one group received placebo and served as control group and another group received Tulsi extract and served as study group. Patients included in the study group were asked to take 5ml of Tulsi extract with plane water in morning and evening before food for three months regularly.Tulsi extract stored at controlled room temperature before and after handing over to patients. Baseline parameters were taken of every patient i.e. BMI, fasting blood sugar, blood pressure, HbA1c, lipid profile. Weekly patients were evaluated for BMI, fasting blood sugar and blood pressure. After three months HbA1c and lipid profile were also estimated.

Exclusion criteria:-Patient suffering from liver diseases, arthritis, pulmonary tuberculosis, malabsorption, alcoholism and non cooperative patients were excluded from the study.

Patients were examined for:-

BMI:- Weight/Height^2 and NCEP ATP III guidelines were used for the grading of BMI ratio.

Blood Pressure:- by syphygnomanometer in resting supine position after 5 minutes rest.

Fasting Blood Sugar:-by glucose oxidase method with stat fax 3300.

Glycosylate haemoglobin (HbA1c):-by ion exchange resin method with HbA1c kit.

Lipid Profile:- *T*rigyceride and Cholesterol:by

colorimetrically using enzymatic kits (GPO-PAP with ATCS) provided by DCRC.

HDL:-CE-CO-PAP enzymatic end point.

LDLandVLDL:-by friedewald formula: VLDLC (mg/dl) + triglceride/5

LDL-C (mg/dl) =Total cholesterol (HDL-C+VLDL-C)

Tulsi extract (Tulsi arka):- Tulsi leaves areused for preparing tulsi ark byAqueous extraction method, is manufactured at Gita Bhawan

Ayurved Sansthan post office Swarga Shram (Uttrakhand), is well equipped with various analytical instruments. TLC method used for analytical data of tulsi ark. Supply of Tulsi arka in 200 ml bottle with sealed air tight lid.

2.1 Stastical analysis

For statistical comparison of data, appropriate statistical model was applied. The subjects were selected on a random basis. Since the study was conducted at one place only, hence geographical and climatric conditions were similar in all the cases. The data is expressed as mean ± SD.

Table 1. Comparison of different parameters between the groups at pre-treatment

Parameter		Control Group		Study Group		p
		Mean	±SD	Mean	±SD	
BMI(Kg/m^2)		28.63	2.66	27	3.23	< .01
WH Ratio		0.95	0.66	0.97	0.06	< .5
BP(mmHg)	Systolic	152.76	8.81	151.30	8.48	< .1
	Diastolic	95.96	2.19	95.76	3.63	< .8
Glycaemic	FBS (mg/dl)	203.06	67.20	209.26	40.15	< .5
Control	HbA$_{1c\%}$	8.83	1.64	8.82	1.25	< .9
Lipid Profile	TC	257.40	16.15	244.04	26.30	< .1
(mg/dl)	TG	176.60	9.36	176.48	16.75	< .9
	HDL	33.02	4.01	33.58	3.47	< .8
	LDL	169.41	10.16	174.91	26.82	< .1
	VLDL	35.32	1.87	35.37	3.84	<.9

Table 2. Comparison of different parameters between the groups at post treatment

Parameters		Control Group		Study Group		t	p
		Mean	±SD	Mean	±SD		
BMI (Kg/m^2)		28.11	2.65	27.10	8.64	.79	<.5
WH Ratio		0.95	0.05	0.93	0.05	2.00	<.5
B.P (mmHg)	SBP	150.20	3.88	138.68	9.84	7.73	<.001
	DBP	93.98	4.04	87.12	8.81	5.77	<.001
Glycaemic	FBS(mg/dl)	202.52	39.87	155.28	20.70	6.87	<.001
Control	HbA$_{1c\%}$	7.93	1.40	7.34	0.89	2.56	<.05
Lipid	TC	256.50	24.70	209.28	29.03	10.83	<.001
Profile(mg/dl)	TG	175.10	18.53	138.32	15.17	16.88	<.001
	HDL	33.74	4.31	39.36	4.25	6.53	<.001
	LDL	167.05	10.33	142.11	27.50	6.01	<.001
	VLDL	33.23	1.85	27.66	3.03	10.92	<.001

3. Result

There was insignificant difference in various parameters in the control group. In this group DBP, HbA1c and VLDL were found significantly changes from 95.96±2.19 to 93.98±4.04, 8.83±1.64 to 7.93±1.40 and 35.32±1.87 to 33.23±1.85.

The BMI in the treatment group slightly changed from 27.00±3.23 to 27.10±8.64 (p<0.9) and it was insignificant. Improvement in systolic and diastolic blood pressure from 151.30±8.48 and 95.76±3.63 to 138.68±9.84 and 87.12±8.81 mmHg were significant at p<0.001 after treatment with Tulsi extract. The mean fasting blood sugar and HbA1c in the treatment group improved from the values of 209.2640.15 and 8.82±1.25 to 155.28±20.70 and 7.34±0.89 (p<0.001) respectively. The significant changes in lipid profile: Total cholesterol (244.04±26.30 to 209.28±29.03, p<0.001), triglyceride (176.48±16.75 to 138.32±15.17, p<0.001), HDL (33.58±3.47 to 39.36±4.25, p<0.001), LDL (174.91±26.82 to 142.11±27.50, p<0.001) and VLDL (35.37±3.84 to 27.66±3.03, p<0.001) were observed in the study group after treatment.

The anthropometric and biochemical indices of both the groups control & study were studied for different variables in the beginning of study and there was no significant difference in baseline parameters. (Table 1)

On comparing both the groups control and study after three months treatment, changes in all the parameters were found significant except W/H ratio and BMI. (Table 2)

4. Discussion

In the traditional system of Indian medicine different parts of Tulsi have been recommended for anti diabetic, antihypertensive adaptogenic, antilipidemic and cardio protective properties.

In this study the significant fall in fasting blood sugar and HbA1c may be attributed to the hypoglycemic effect of Tulsi. Liu JP. et. Al (2004) also observed a Cochrane review of the use of traditional plants in hyperglycemia found a hypoglycemic response to holy basil verses placebo in one small trial (N=40) [9]. Chattopadhyay has also reported a well definedrole of alcoholic extract of Tulsi leaves in suppressing blood sugar level in normal glucose fed hyperglycemia, insulin treated and diabetic rats as compared to control animals [10] Agrawal et al have suggested that Tulsi leaves improve the beta cell function and enhance insulin secretion [11]. Sarkar et al have reported that in dry weight basil leaves are apparently more effective in lowering the blood glucose levels as compared to dry seeds [12]. Satyawati et al have report that Tulsi leaves inhibit absorption of glucose from the intestine but the nature of active principle and exact mode of its action remains unclear [13]. Several studies show that Tulsi has hypoglycemic action.

In our study there is significant fall in systolic and diastolic blood pressure and this will support the antihypertensive effect of Tulsi. However, in a scientific study, no significant effect was observed on dog's blood pressure and guinea pig heart [14]. On the other hand aqueous extract of Tulsi has been found to possess hypotensive myocardial depressant and bradycardiac effect [15]. In a very recent study Tulsi oil was injected intravenously in anaesthetized dog and found to have hypotensive effect. It was postulated that the hypotensive effect is possibly due to peripheral vasodilatation. Eugenol oil is the most important constituent present in leaves of Tulsi. The oil contains essential fatty acid like lenoleic and lenolenic acids which produce prostaglandins: PGE1 and PGE3 and also inhibit formation of PGE2. These two

PGE1 and PGE3 produce vasodilatory action and cause hypotensive effect.

In present study there is significant fall in serum cholesterol, Triglyceride, LDL and VLDL in Tulsi treated group. Rai *et al* observed that eugenol is oil present in Tulsi leaves and this oil has been shown to cause inhibition of lipid per oxidation [16]. Eshart halim *et al* observed that oral administration of ocimum sanctum mixed with diet for eight weeks to diabetic (streptozotocin induce) rats shown a significant reduction in fasting blood sugar, serum lipid profile, lipid per oxidation products and also there is improvement in glucose tolerance [8]. Mani et al have reported significant reduction in lipid profile in serum and tissue lipids in normal and diabetic rats treated with Tulsi leaves powder [17].

5. Conclusion

It can be concluded that in metabolic syndrome, Tulsi therapy significantly reduces blood sugar, blood pressure and lipid profile. It shows the therapeutic effect of Tulsi and it may be used as an adjunct with diet and drugs in the management of metabolic syndrome.

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