

Effect of Supplementation of Tulsi (*Ocimum sanctum*) and Neem (*Azadirachta indica*) Leaf Powder on Diabetic Symptoms, Anthropometric Parameters and Blood Pressure of Non Insulin Dependent Male Diabetics

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ABSTRACT The incidence of diabetes is increasing all over the world affecting more than 246 million people. Ninety non insulin dependent male diabetic subjects in the age group of 40-60 years were selected from PAU, Ludhiana to study the effect of supplementation of *tulsi* and *neem* leaves on the signs and symptoms anthropometric parameters and blood pressure of the diabetic subjects. General information of the subjects was recorded by interview schedule. After one month control period ninety subjects were divided into three groups of 30 each. Group I was given *tulsi* leaf powder, group II was given *neem* leaf powder and group III given mixture of both leaf powder in the form of capsules. Daily dosage of four capsules i.e. 2 g powder (Lunch and dinner) was given and supplementation was carried out for a period of 3 months. The most common symptoms of diabetes observed in diabetic patients were polydipsia, polyurea, polyphagia and tiredness. Some other symptoms were sweating, burning feet, itching and headache. Significant reduction in all the diabetic symptoms was observed in all the three groups but maximum reduction was seen in group III patient who were given mixture of *tulsi* and *neem* leaf powder. Significant percent reduction in the symptoms like polydipsia (35, 33, 40), polyphagia (21, 35, 40) and headache (27, 38, 40) was observed in group I, II and III respectively. It can be concluded from the study that *tulsi* and *neem* leaves are helpful in reducing the diabetic symptoms and blood pressure of the subjects. Non significant improvement in the anthropometric parameters of the subjects was observed after supplementation of *tulsi* and *neem* leaves powder of the patients. Therefore these leaves should be regularly consumed by the diabetic patients to get relief from the diabetic symptoms.

INTRODUCTION

The incidence of diabetes mellitus is increasing all over the world affecting more than 150 million people and would rise to 330 million by the year 2025 (John 2005). India has been declared as the "Diabetic capital of the world affecting more than 33 million people and it would rise to 74 million by the year 2025 (Bajaj 2004). According to International Diabetes Federation, Diabetes currently affects 246 millions people worldwide and India has the largest number of people with diabetes i.e., 40.9 million (IDF 2007) Modern allopathic system of medicine is greatly accepted in the treatment of diabetes throughout the world but it has not been able to reach the remote areas for various reasons. These days great attention is given to the management of diabetes with medicinal plants along with dietary restrictions. Moreover toxicity and side effects of modern system of medicine have high lighted the importance of relevance of traditional medicinal plants. Several studies have shown that *tulsi* as

an extract and as a dietary component have hypoglycemic action. Diabetes is a disease of excessive sweetness so bitterness like *neem* can be used to counteract the imbalance. Looking into the beneficial effects of *tulsi* and *neem* leaves present study was planned to see the effect of *tulsi* and *neem* in the management of diabetic symptoms, anthropometric parameters and blood pressure.

METHODOLOGY

a) Procurement and Processing of the Material: Fresh leaves of *tulsi* and *neem* were procured from department of Agronomy, Punjab Agricultural University, Ludhiana. After washing, the leaves were shade dried and then oven dried at 40°C for six to eight hours and then powder was made and filled in the capsules of 500 mg capacity. Three types of capsules were prepared i.e. *neem* leaf powder, *tulsi* leaf powder and *neem* and *tulsi* leaf powder in the ratio of 1: 1.

b) Selection of the Subjects: A group of ninety

male non insulin dependent diabetic patients in the age group of 40-60 years free from serious complications of diabetes were selected from Punjab Agricultural University Hospital, Ludhiana. General information about the subjects pertaining to age, education, activity, income marital status, likes and dislikes, family size and type was recorded by interview schedule.

c) Feeding of the Subjects: All the subjects were kept under observation for one month period. During this period, no treatment was given to the subjects except medicine prescribed by the doctor. After one-month control period, ninety subjects were divided into three group of 30 each. Group I was given *tulsi* leaf powder, group II was given *neem* leaf powder and group III was given mixture of both leaf powder in the form of capsules. Daily dosage of four capsules i.e. 2 g powder (Lunch and dinner) was given and supplementation was carried out for a period of 3 months.

d) Diabetic Symptoms: Symptoms like polydipsia, polyurea, polyphagia, tiredness, sweating burning sensation, itching and headache were observed in diabetic subjects before and after supplementation of tulsi and neem leaves.

e) Anthropometric Parameters: Height, weight, mid upper arm circumference, tricep skin fold thickness of the subjects were measured before and after experimental period according to method given by Jelliffe (1966).

f) Blood Pressure: Blood pressure of the subjects was recorded with sphygmomanometer by physician (Maclead 1984)

RESULTS AND DISCUSSION

The general information of the subjects is given in Table 1. Ninety subjects selected for this study were in the age of 40-60 years. Twenty two per cent were between 40-50 years and 78 per cent were between 50-60 years. None of the subject was illiterate, 34 per cent were educated up to high school, 30% up to graduation and rest 36% were postgraduate. Eighty four per cent of the subjects were engaged in sedentary life style and 16 per cent in moderate activity. Yaznik (2004) suggested that urban life style, including poor diet; sedentary habits promote obesity, insulin resistance and type II diabetes. Nearly 66% of the subjects were going for walk daily 24% were doing cycling and 10% were doing yoga and walk both exercise has been reported to be beneficial

Table 1: General information of the subjects

General information	Subjects (n=90)	
	Number	Percentage
<i>Age (years)</i>		
40-50	20	22.0
50-60	70	78.0
<i>Religion</i>		
Hindu	42	47.0
Sikh	48	53.0
<i>Education</i>		
High school	31	34.0
Graduate	27	30.0
Post graduate	32	36.0
<i>Occupation</i>		
Service	90	100.0
Business	-	-
<i>Activity</i>		
Sedentary	76	84.0
Moderate	14	16.0
<i>Physical Exercise</i>		
Walk	59	66.0
Cycling	22	24.0
Wa + yoga	9	10.0
<i>Family Type</i>		
Nuclear	56	62.0
Joint	34	38.0
<i>Family Size</i>		
Small (1-4)	54	60.0
Medium (5-8)	27	30.0
Large (>8)	9	10.0

for maintaining body weight and increases the quality of life (Stone et al. 2001).

It was observed that 62 percent subjects belong to nuclear family while 38 per cent belong to joint. Sixty percent subjects had family members from one to four 30% have 5-8 family members and 10 percent have were than 8 family members.

Economic status of the diabetic subjects is given in Table 2. Seventy eight per cent of subjects had income more than Rs. 10000 per month, 9 per cent between 8000 to 10000. Sixty nine per cent of the subjects had per capita income more than Rs. 2500.

The most common symptoms of diabetes observed in diabetic patients were polydipsia, polyurea, polyphagia and tiredness (Table 3). Some other symptoms were sweating, burning feet, itching and headache. Significant reduction in all the diabetic symptoms was observed in all the three groups but maximum reduction was seen in group III patients who were given mixture of tulsi and neem powder. Significant percent reduction in the symptoms like polydipsia (35, 33, 40), polyphagia (21, 35, 40) and headache (27, 38, 40) was observed in group I, II and III

Table 2: Economic status of the subjects

Economic status	Subjects (n=90)	
	Number	Percentage
<i>Family Income /Month (Rs.)</i>		
<6000	4	4.0
6000-8000	8	9.0
8000-10000	8	9.0
≥ 10000	70	78.0
<i>Per Capita Income/Month (Rs.)</i>		
1000-1500	3	3.0
1500-2000	8	9.0
2000-2500	17	19.0
>2500	62	69.0
<i>Family Income (Rs.)</i>		
Mean	10371	
SE	±431.75	
<i>Per Capita Income (Rs.)</i>		
Mean	2531	
SE	±109.41	

respectively. Similarly Vijyalakshmi and Amirthavani (2002) observed reduction in tiredness in diabetic subjects after supplementation with herbal formulation containing green leaf powder. Phenolic compounds like eugenol, apigenin and other flavonoids present in tulsi have excellent antioxidant activity. Urosolic acid from sacred basil protect against lipid peroxidation. Neem leaf extracts reduced lipid profile levels significantly (Khosla et al. 2000).

Anthropometric Parameters

The anthropometric parameters like height, weight, body mass index (BMI), mid upper arm circumference (MUAC), tricep skinfold thickness (TSFT) and waist to hip ratio (WHR) are presented in Table 4. The mean height of the subjects before and after supplementation ranged from 154.35 to 172.3 cm with mean value of 158.3±1.66 cm, 163±3.16 cm and 161.3±3.14 cm of

group I, II and III respectively. The average weight of the subjects before and after feeding ranged from 68 to 85 kg with mean value of 75.4±1.82 kg in group I, 74.8±1.57 kg in group II and 73.6±2.5 kg in group III. There was no significant decrease in weight after supplementation of the tulsi and neem leaves. Sadana and Hira (1997) stated that socio-economic status and income were also found to be factors which clearly influence the body weight and height. A derived index of fatness from weight and height was used to classify the subjects into grades of obesity according to classification prepared by James et al. (1988). The percentage of severe overweight subjects was 30, 36.7 and 33.3 in Group I, II and III respectively. However percentage of moderate overweight subjects in group I, II and III respectively was 63.3, 47, 53 while there was no subject in the category of underweight subjects (Table 5).

The range of BMI of subjects before was 24 to 37 kg/m². Corresponding mean values of three group are 28.2±0.31, 28.11±0.7, 28.4±0.97 (Table 4). No significant change was found in BMI of the subjects before and after supplementation of medicinal plants. Kamayika et al. (1994) in their study found that BMI of more or equal to 25 was associated with high blood pressure. The mid upper arm circumference (MUAC) of the subjects before feeding ranged from 23.5 cm to 36.5 cm with mean value of 26.87±0.77 cm, 27.31±0.78 cm and 27.56±0.70 cm of group I, II and III respectively. Non significant decrease was observed in MUAC of subjects after supplementation of medicinal plants and values were low as compared to standard value of 29.3 cm given by Jelliffe (1966).

Tricep skin fold thickness (TSFT) of the subjects ranged from 12 mm to 18.5 mm in all the

Table 3: Signs and symptoms of diabetes among subjects before and after supplementation of tulsi leaves neem leaves powder and mixture of tulsi and neem leaves powder

Symptoms	Group - I			Group - II			Group - III		
	Before	After	Percent reduction	Before	After	Percent reduction	Before	After	Percent reduction
Polydypsia	23	15	35.0	21	14	33.0	24	14	40.0
Polyurea	21	17	19.0	19	13	32.0	22	16	27.0
Polyphagia	19	15	21.0	17	11	35.0	15	9	40.0
Tiredness	15	13	13.0	11	9	18.0	16	12	25.0
Sweating	9	6	33.0	10	6	40.0	10	8	20.0
Burning foot	7	4	43.0	9	5	44.0	7	5	29.0
Itching	5	4	20.0	6	5	16.0	6	5	17.0
Headache	11	8	27.0	8	5	38.0	12	7	40.0

Table 4: Anthropometric measurements of diabetic subjects before and after supplementation of tulsi and neem leaves powder

Symptoms	Group - I (n=30)			Group - II (n=30)			Group - III (n=30)			Reference standard
	Before	After	t-value	Before	After	t-value	Before	After	t-value	
Height (cm)	158.3 ±1.66	158.3 ±1.66	-	163.0 ±3.16	163 ±3.16	-	161.3 ±3.14	161.3 ±3.14	-	-
Weight (kg)	75.4 ±1.82	74.5 ±1.86	NS	74.8 ±1.57	73.95 ±3.47	NS	73.6 ±2.51	72.6 ±2.67	NS	-
BMI (kg/m ²)	28.2 ±0.31	27.58 ±0.97	NS	28.11 ±0.71	27.62 ±1.21	NS	28.41 ±0.97	28.03 ±1.11	NS	20-25**
MUAC (cm)	26.87 ±0.77	26.49 ±0.69	NS	27.32 ±0.78	26.91 ±0.72	NS	27.56 ±0.70	27.31 ±0.72	NS	29.3*
TSFT (mm)	11.9 ±0.98	11.73 ±0.83	NS	12.31 ±1.03	12.12 ±1.09	NS	11.79 ±0.98	11.57 ±1.02	NS	12.5*
WHR	0.91 ±0.008	0.87 ±0.001	NS	0.89 ±0.003	0.87 ±0.12	NS	0.86 ±0.023	0.83 ±0.024	NS	1*

* Jelliffe (1966)

** James et al. (1988)

NS - Non significant

three groups. It was found that there was non significant decrease in skinfold thickness after supplementation of these medicinal plants. TSFT values of subjects were comparable to standard (12.5 mm) laid down by Jelliffe (1966).

The waist to hip ratio of the subjects ranged from 0.79 to 1.05 before feeding. The corresponding mean value was 0.91 ± 0.008 , 0.89 ± 0.03 and 0.86 ± 0.023 in group I, II and III respectively. Non significant change was found in value of WHR of subjects after feeding the medicinal plants. Mean WHR was found to be slightly lower than standard values of one for males (Fig. I). Gupta (2000) suggested that increased abdominal adiposity is associated with cardiovascular risk factors.

Blood Pressure

Effect of neem and tulsi leaf powder supplementation on blood pressure of the subjects is presented in Table 6. Mean systolic blood pressure of the subjects before supplementation of medicinal plants was 160 ± 1.86 mmHg, 155 ± 1.52 mmHg and 159 ± 1.67 mmHg in Group I, II and III respectively and mean diastolic pressure of three was 98 ± 1.03 mmHg, 91 ± 1.67 mmHg, and 88.0 ± 0.97 mmHg, in group I, II and III respectively. A significant decrease in blood pressure of the subjects was observed after supplementation of medicinal plants. It has been observed that compound nimbidin from neem leaves cause blood vessels to dilate and may be responsible for reducing blood pressure (Arivazhagan et al. 2000).

CONCLUSION

Supplementation with leaf powder of tulsi, neem and mixture of both upto 2 gram daily in the form of capsules to diabetics helped in the reduction of their diabetic symptoms. Significant reduction in blood pressure level of the subjects was observed after supplementation of these medicinal plants. Supplementation with these medicinal plants showed non significant changes in anthropometric measurements of the subjects. It was concluded from the study that tulsi and neem leaves should be regularly consumed by the diabetics to get relief from diabetic symptoms and blood pressure.

RECOMMENDATION

Efforts should be made to commercial these

Table 5: Distribution of subjects according to grades of obesity.

BMI	Interpretation of BMI	Group - I		Group - II		Group - III	
		No.	%age	No.	%age	No.	%age
<20	Underweight	-	-	-	-	-	-
20-25	Acceptable weight	2	6.67	5	16.6	4	13.3
25-30	Moderate weight	19	63.3	14	46.7	16	53.3
>30	Severe overweight	9	30.0	11	36.7	10	33.3

Table 6: Blood pressure of subjects before and after supplementation of tulsi and neem leaves powder

Blood pressure (mm Hg)	Group - I (n=30)			Group - II (n=30)			Group - III (n=30)			Normal range
	Before	After	t-value	Before	After	t-value	Before	After	t-value	
Systolic	160 ±1.86	152 ±1.59	4.0*	155 ±1.52	149 ±1.32	3.9*	159 ±1.67	151 ±1.72	5.1*	<120
Diastolic	98 ±1.03	92 ±1.16	4.1*	91 ±1.67	86 ±1.21	3.4*	88 ±0.97	80 ±1.02	4.3*	<80

- Raghuram et al. (1993) *Significant at 1% level

capsules prepared by using tulsi and neem leaves as these are safe, inexpensive and convenient to consume by diabetic patients.

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