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EFFECT OF SPROUTED FENUGREEK SEEDS ON NON INSULIN DEPENDENT DIABETICS

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ABSTRACT

Present study is an endeavour to examine the effect of supplementation of sprouted fenugreek seeds on blood glucose, lipid profile and blood pressure of non insulin dependent diabetic males. A group of 60 male Non Insulin Dependent Diabetes Mellitus (NIDDM) patients in the age group of 40-60 years free from serious complications of diabetes were selected from Punjab Agricultural University Hospital, Ludhiana. Subjects were divided into 2 groups i.e. experimental (E) and control (C) group consisting of 30 subjects in each group. Subjects of E group were supplied 25 g sprouted fenugreek seeds per day for two months while no supplementation was given to the C group. The results revealed that mean age of onset of diabetes was 45 and 47 years in E and C group, respectively. Supplementation of sprouted fenugreek seeds resulted in a significant ($P \leq 0.01$) decrease in fasting blood glucose level (20.34 percent) and post prandial glucose level (15.1 %). Lipid profile of the subjects also showed percentage decrease of 10.1, 23, 12.4 and 23 per cent in total cholesterol (TC), triglycerides (TG), Low density lipoprotein cholesterol (LDL-C) and very low density lipoprotein cholesterol (VLDL-C) respectively in experimental group. Further TC: HDL and LDL: HDL ratios were also decreased 18.3 and 21.1 percent respectively. However, 11 percent increase was observed in HDL-C. Regarding the blood pressure of the subjects, Systolic blood pressure was decreased significantly ($P \leq 0.01$) fom 132 to 128mmHg and Diastolic blood pressure ($P \leq 0.05$) fom 84 to 81 mmHg after the supplementation, thus helping in retarding the secondary complications of diabetes.

Key words: Blood glucose, Lipid profile, NIDDM, Sprouted fenugreek seeds, Supplementation

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DIABETES is an important human ailment afflicting many from various walks of life in different countries. In India it is proving to be a major health problem, especially in the urban areas. The trend is linked with moves from traditional to modern life style and changes in diet and physical activity (Malagi and Naik, 2007).Spectacular increase in the incidence and prevalence of this chronic disease is destined to have enormous impact on mortality, morbidity and health care resources. According to International Diabetic Federation, Diabetes currently affects 246 million people worldwide and India has the largest number as 40.9 million (IDF, 2007). India has been declared as the "Diabetic capital of the world". By 2030 there would be 366 million diabetics throughout the world and 79.44 million diabetics in India alone (WHO, 2007). More than 90 percent of the diabetic patients in India suffer from NIDDM (Mishra *et al.*, 2001).

Inadequate secretion or function of insulin or its receptors results in impaired metabolism of glucose, carbohydrates, proteins and fats characterized by hyperglycemia and glycosuria. Though there are various approaches to reduce the ill effects of diabetes and its secondary complications, herbal formulations are preferred due to lesser side effects and low cost.

Fenugreek was reported to have hypoglycemic effect due to delayed gastric emptying caused by the fibre content and hypocholesterolemic property due to increased conversion of hepatic cholesterol to bile salts due to loss in the faeces, or complexes of these substances with fenugreek fibre and saponins (Habori and Raman, 1998). Raw seeds of fenugreek are bitter in taste but after sprouting the taste is improved, in addition to this, Vit C is synthesized, dormant enzymes are activated and protein digestibility and availability of calcium, iron and zinc are also increased appreciably due to reduction in phytic acid content as antinutrient (Hooda and Jood, 2007).

Fenugreek seeds with its high concentration of functional nutrients are emerging as an important therapeutic food for diabetic patients in recent years. So keeping in view all the beneficial effects of sprouted fenugreek seeds, the present study was designed to investigate the effect of supplementation of sprouted fenugreek seeds on blood glucose and lipid profile of the of non insulin dependent diabetes males.

MATERIALS AND METHODS

Selection of subjects

A group of 60 male NIDDM patients in the age group of 40-60 years free from serious complications of diabetes were selected purposively from Punjab Agricultural University Hospital, Ludhiana. The patients were regularly visiting hospital and were not hospitalized. Study was carried out from January to march 2008. Subjects having fasting blood glucose level <160 mg/dl were divided into two groups i.e. experimental (E) and control (C) group consisting of 30

subjects in each group. Diabetic information of the subjects was recorded by questionnaire.

Supplementation of Fenugreek sprouts

Fenugreek seeds (*Trigonella foenum graecum*) were bought from the market. Seeds were cleaned, soaked in water overnight at room temperature, tied in a wet muslin cloth and hung on a hook. Constant sprinkling of water was done. After 48 hours sprouts were appeared. Five grams of fenugreek seeds yield 7.5 g of sprouted fenugreek seeds. Subject of E group were supplemented with 25 g of sprouted fenugreek seeds/ day for 2 months along with medication while no supplementation were given to the subjects of control group. Sprouts were packed in polythene bags and supplied to subjects in E group on alternate day and consumption of sprouts was monitored regularly.

Analysis of blood samples

Fasting and postprandial (PP) blood glucose levels of the subjects were analyzed as per standard methods of Trinder (1969) before and after the experimentation.

Blood was also analyzed for lipid profile before and after the experimentation of 60 days. Serum cholesterol was analyzed as per standard method given by Richmond (1973). Serum triglyceride was estimated by using method given by Fossati and Principle (1982). High density lipoprotein-cholesterol (HDL-C) was measured as per standard method given by Lopes Virella *et al* (1977). Further, low density lipoprotein- cholesterol (LDL-C) and very low density lipoprotein- cholesterol (VLDL-C) were calculated using equations given by Friedl Wald *et al* (1972).

Statistical analysis

The data was statistically analyzed using paired t test of significance which was calculated using a Microsoft Excel Programme package.

RESULTS AND DISCUSSION

Diabetic information of the subjects

The mean age of onset of diabetes among subjects was 45.1±2.92 and 47.3±1.96 years in E and C group, respectively. Whereas mean duration of diabetes was 6.8±1.68 and 5.0±1.82 years in E and C group, respectively. Family history of the subjects revealed that in E group 73.3 per cent of the subjects had positive family history of diabetes with either a diabetic father (20%) or diabetic mother (36.7%) or diabetes in both the parents (16.7%) whereas in C group, 80 per cent subjects had a positive history of diabetes with either diabetic mother (30%) or diabetic father (26.7%) or diabetes in both parents (23.3%).Positive family history of diabetes indicating the possibility of hereditary effect on subjects.

Most common symptoms observed in E and C group were tiredness (73.3 and 53.3%), polyuria (63.3 and 46.7%), headache (56.7 and 70 %), polyphagia (43.3 and 50%) and polydypsia (36.7 and 43.3%). Some of the less common symptoms were delayed healing of wounds, drowsiness, excessive sweating (Table1)

Table1. Symptoms observed before diagnoses of diabetes* (n=30)

Symptoms	*Experimental group*	*Control group*
Polydypsia	11(36.7)	13 (43..3)
Polyphagia	13(43..3)	15 (50.0)
Polyuria	19(63..3)	14 (46.7)
Nocturia	6(20.0)	3 (10.0)
Tiredness	22(73..3)	16 (53..3)
Delayed healing of wounds	5(16.7)	3 (10.0)
Weight loss	8(26.7)	11 (36.7)
Drowsiness	2(6.7)	1 (3..3)
Itching	-	1 (3..3)
Headache	17(56.7)	21 (70.0)

Figures in parenthesis are percentages
* Multiple responses

Fasting and postprandial blood glucose levels before and after the experimentation

The mean fasting and post prandial glucose levels of subjects before and after the supplementation are presented in Table 2. A significant ($P \leq 0.01$) decrease was observed in fasting blood glucose and post prandial glucose level of

Table 2. Blood glucose levels of the selected NIDDM subjects (n=30 each)

Blood glucose (mg/dl)	*Group*	*Before supplementation*	*After supplmentation*	*Percentage difference*	*t-value*	*Normal values++*
Glucose (Fasting)	Experimental	150.6±18.42	120±12.33	20.34	6.56**	70-110
	Control	149.1±23.92	147±24.27	1.42	1.10^{NS}	
Glucose(Post prandial)	Experimental	261.9±16.55	222.4±14.21	15.09	7.21**	120-140
	Control	268.5±18.96	264.1±19.81	1.62	1.52^{NS}	

The values are mean±SE
++ Raghuram *et al* (1993)
** Significant at 1%
NS Non significant

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subjects of E group after the fenugreek sprouts supplementation. The percent reduction in E group was 20.3 per cent in fasting blood glucose and 15.1 per cent reduction in postprandial blood glucose, whereas in C group a non-significant change was observed. Delayed gastric emptying caused by the fibre content in sprouted fenugreek seeds led to reduction of fasting and postprandial blood glucose levels.

Chandra and Aruna (1997) also reported a significant reduction in fasting and PP blood glucose levels after supplementation of sprouted fenugreek seeds to NIDDM subjects. Amirthaveni and Thirumanidevi (2004) also reported a significant reduction in postprandial glucose level of diabetics after supplementation of fenugreek seeds.

Blood lipid profile of the subjects before and after the experimentation

Lipid profile of the subjects before and after the experimentation is given in Table 3. Lipid profile of E group showed a significant ($P \leq 0.01$) reduction in total cholesterol from 226 to 203 mg/dl after the supplementation. Triglycerides were also decreased from 170.3 to 131 mg/dl and LDL-C from 147.9 to 129.5 mg/dl. Further reduction was also observed in VLDL-C from 34 to 26.2 mg/dl, TC: HDL ratio from 5.90 to 4.8 and LDL: HDL ratio from 3.9 to 3.1 in E group, whereas a significant increase was observed in HDL-C level from 38.03 to 42.20mg/dl in E group ($P \leq 0.01$). On the other hand change in values in C group was found non-significant. Percentage decrease of 10.09, 23.02, 12.45 and 23.02 was observed in TC, TG, LDL-C and VLDL-C respectively in E group. While 10.96 per cent increase was found in HDL-C. The TC: HDL ratio and HDL: LDL ratio was also decreased 18.30 and 21.13% respectively. Thus supplementation of sprouted fenugreek seeds has beneficial effect in improving the diabetic state by reducing the blood glucose levels up to 15 to 20% and lipid levels up to 10-23%. Sowmya and Rajyalakshmi (2004) also reported hypocholesterolemic effect of germinated fenugreek seed powder. Further, Kochhar *et al* (2007) also reported increased HDL-C levels and decreased TC:HDL and LDL:HDL ratios of 60 NIDDM subjects after the supplementation of fenugreek seeds.

Blood pressure of the subjects before and after the experimentation

The mean initial diastolic blood pressure of the subjects decreased significantly (P£0.01) from 84±2.32 to 81±1.71mmHg in experimental group after the supplementation, while the mean diastolic blood pressure in control group increased non- significantly from 84.5±1.95 to 85±1.60 mmHg after the study (Table 4). However, the values were higher than the normal value (80mmHg) given by Raghuram *et al* (1993). Badruddin *et al* (2001) observed that high blood pressure is common among the people with type 2 diabetes and estimated that between 20 to 60 percent of people with type 2 diabetes had high blood pressure. The mean initial systolic blood pressure recorded was 132±3.65 and 137.55± 4.86 mmHg in experimental and control group, respectively and the corresponding values after the two months of study were 128.45±2.10 and 139±3.34 mmHg. After the supplementation of fenugreek sprouts in E group, decrease

Table 3 Lipid profile of the selected NIDDM subjects

Variable	*Group*	*Before supplementation*	*After supplementation*	*Percentage difference*	*t-value*	*Normal values*
Total Cholesterol (mg/dl)	Experimental	226.00±8.36	203.18±6.23	10.09	4.97**	<200[β]
	Control	239.52±9.23	238.48±9.06	0.43	.96[NS]	
Triglycerides(mg/dl)	Experimental	170.26±9.14	131.05±8.56	23.02	5.24**	<150[β]
	Control	204.52±12.20	206.86±11.23	1.14	0.80[NS]	
HDL(mg/dl)	Experimental	38.03±3.75	42.20±3.45	10.96	6.58**	40-70[β]
	Control	36.15±2.78	37.02±1.95	2.40	1.22[NS]	
LDL(mg/dl)	Experimental	147.95±5.92	129.53±4.76	12.45	3.57**	80-160[β]
	Control	152.00±7.89	156.37±8.45	2.88	0.68[NS]	
VLDL(mg/dl)	Experimental	34.05±1.24	26.21±0.91	23.02	3.14**	<40[β]
	Control	40.9±1.83	41.40±2.11	1.22	0.56[NS]	
TC:HDL	Experimental	5.90±3.22	4.82±2.96	18.30	4.01**	<4.5[Y]
	Control	6.63±5.78	6.43±5.12	3.01	0.34[NS]	
LDL:HDL	Experimental	3.88±1.72	3.06±1.39	21.13	2.43*	<3[Σ]
	Control	4.21±2.83	4.24±3.06	0.71	-	

The values are mean±SE

β	Raghuram *et al.* (1993)	**	Significant at 1%
Y	Anonymous (2007)	*	Significant at 5%
Σ	Castelli *et al.* (1977)	NS	Non Significant

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Table 4 Blood pressure values of the subjects (n=30)

Blood pressure(mm Hg)	*Before supplementation*	*After supplementation*	*Difference*	*t-value*	*Normal values*♣
Diastolic					
Experimental	84±2.32	81±1.71	-3	2.19*	<80
Control	84.5±1.95	85±1.60	0.5	.69NS	
Systolic					
Experimental	132±3.65	128.45±2.10	-3.55	4.12**	<120
Control	137.55±4.86	139±3.34	1.45	1.21NS	

The values are mean±SE

♣ Raghuram *et al.* (1993)

* Significant at 5%

** Significant at 1%

NS Non significant

in the systolic blood pressure was statistically significant ($P \leq 0.01$), while in case of control group the systolic blood pressure increased non-significantly.

Thus it can be concluded supplementation of sprouted fenugreek seeds (25 g/day) is an effective measure to improve the diabetic state by reducing blood glucose and lipid levels. Therefore it is recommended the diabetics should incorporate sprouted fenugreek seeds in their daily diet as *bhurji / vegetable*, stuffed *parantha* or *chapatti* and sprouts *chaat* etc. Efforts should be made to commercialize the sprouts of fenugreek seeds to increase its consumption by diabetics.

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