Research Article

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A PROSPECTIVE STUDY TO SEE THE EFFECT OF FENUGREEK SEED POWDER AS HYPOGLYCEMIC AGENT ON TYPE II DIABETES MELLITUS

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Abstract: This prospective study was designed to see the hypoglycemic properties of fenugreek seeds on the noninsulin-dependent diabetes mellitus patients. Fenugreek seed powder with a dose of 15mg/day was given to 34 noninsulin-dependent diabetes mellitus patients and 15 healthy controls for 30 days. The blood glucose (FBS and PPBS), Liver function test, lipid profile and Kidney function test were measured after 15th, 30th and 45th day. We observed there was a significant reduction in FBS, PPBS and Hba1C levels after administration of Fenugreek seeds in diabetic patients. However no change was observed in liver functions, lipid profile and kidney functions which show fenugreek seeds have no toxicological effect. Fenugreek seed can be used as hypoglycemic agent in NIDDM patients. However close monitoring of vitals should always been done.

Keywords: Diabetes mellitus type II, Fenugreek, HbA1c

INTRODUCTION

Diabetes mellitus is a chronic illness due to endocrine dysfunction, its prevalence which is being increased in human population. Uncontrolled, diabetes is associated with various acute and chronic comorbidities. Non-insulin Dependent Diabetes Mellitus (NIDDM) is a rapidly growing health concern in both developed and developing nations. NIDDM accounts for over 90% of cases globally (1, 2). According to the World Health Organization (WHO), in 2011, approximately 364 million people globally suffer from diabetes (DM), with projections that DM-related deaths will double from 2005 to 2030 (3). In 2004, 3.4 million people died directly from the consequences of high blood glucose. The prevalence of DM worldwide was calculated as 2.8% in 2000. This is expected to increase to 4.4% by 2030 (4). The growing concern is the epidemic growth in obesity and increase in the elderly population, which will continue to increase the prevalence of DM. Another study, using data from 91 countries, estimates that the prevalence can be as high as 7.7% (439 million adults) by 2030 (2). Other estimates include a 70% increase in DM in developing countries and 20% increase in developed nations.

The metabolic aspect of diabetes is characterized by moderate to severe hyperglycemia and impaired metabolism of nutrients, including proteins, carbohydrates and lipids (5).The side effects of taking insulin and oral hyperglycaemic agents have brought about a growing interest among this group of patients for using natural products having anti diabetic activity (6).Herbs are rich sources of natural antioxidants, and are used in traditional medicine for the control and treatment of many diseases. The reducing effect of a large number of these plants on blood glucose has been confirmed in animal models and clinical studies (7-9). Studies on animals have shown that more than 400 plant species have hypoglycemic activity and several laboratories are isolating edible herbal hypoglycemic compounds. Among the herbal drugs whose effect on blood sugar reduction has been proved in several human and animal studies are *Salvia officinalis, Trigonella foenum* and Ginseng (7, 10). Antioxidant properties of S. Officinalis L (Sage) leaves are known (7). Moreover, the hypoglycemic effect of the alcoholic extract of *T. foenumseeds* has been confirmed in laboratory animals (11, 12) and the hypoglycemic effect of its extract has been studied in a limited number of healthy volunteers (13). In this study, the combination of *S. officinalis* (45mg), *T. Foenum* seeds (50 mg) and *Ginseng* (60 mg) was prepared as glycogol tablet and the effect of this compound on blood glucose, glycosylated haemoglobin (HbA1c), lipid profile, liver and kidney function tests were investigated.

Therefore, promoting an active lifestyle or regular exercise has become the highest public health priority in that country to overcome the onslaught of type 2 diabetes. Also, the search for dietary adjuncts along with usual medical care to treat this life altering disease has become more important and dietary supplements that can modulate glucose homeostasis and potentially improve lipid parameters would be desirable. Fenugreek is a dietary supplement that may hold promise in this regard and is one of the oldest medicinal plants, originating in India and Northern

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Africa and dating back to ancient Egyptian times (14).

In Pakistan and India, fenugreek is commonly consumed as a condiment (15) and used medicinally as a lactation stimulant (16). Fenugreek seeds also lower serum triglycerides, total cholesterol (TC), and low-density lipoprotein cholesterol (LDL-C) (17). The lipid lowering effect of fenugreek might also be attributed to its estrogenic constituent, indirectly increasing thyroid hormones (18). The plant protein in fenugreek is 26%, so it might exert a lipid lowering effect (19). Since a high proportion of diabetic patients in sub-continent suffer from malnutrition, the use of fenugreek which is rich in protein and fiber (48%), has a distinct advantage in these patients (20).

India is a land of herbal products and plant-based vegetarian diets. Wider acceptance of the medicinal value of foods and their use will cut down the health care costs as well. The health benefits of functional foods should, in fact, extend beyond their macro- and micronutrient composition. Although fenugreek has suggested for many conditions, it has been most studied as treatment for diabetes and high cholesterol. This paper explores the demonstrated clinical or/and experimental anti-diabetic functional food ingredients that prevents or slows down the development of diabetes. Eating is a major aspect of daily living, one that may influence the development of diabetes and its subsequent progression. Liver function test and renal function test of these patients will also be monitored to see whether fenugreek seed powder cause any adverse effect on functioning of liver and kidney.

MATERIAL AND METHOD

The present study was carried out in the Department of Biochemistry, Sri Aurobindo Institute of Medical Science, Indore. Subjects were classified into four groups depending upon the diabetes status

Group 1 (N=9): subjects who have newly diagnosed as diabetics were grouped in group 1. They were not taking oral hyperglycemic drug.
Group 2 (N=11): subjects having controlled diabetic cases (HbA1c=6-9%) and on oral hypoglycemic drugs.
Group 3 (N= 14): subjects having uncontrolled diabetes (HbA1c >9.0%) and on oral hypoglycemic drug
Group 4 (N=15): Euglycemic healthy controls were grouped in this group.

Fenugreek seed powder in doses of 5gm TDS before meal were given to all subjects from 0 days to 30th days.

The blood samples were collected on the day of administration of fenugreek seed powder and then on 15th, 30th and 45th day. After 30th day the fenugreek seed powder was withdrawn. Each sample was investigated for blood glucose (fasting FBS and Post prandial PPBS), liver function test (Serum bilirubin, Alkaline Phosphates ALP and SGPT), and renal function tests (blood urea, Serum creatinine and serum Uric Acid) and lipid profile (Total Cholesterol (TC), triglyceride (TG), HDL, LDL). Glycosylated hemoglobin (HbA1c) was estimated on 0 day and 45 day.

Statistical analysis:

All the data were analyzed using SPSS 20.0. Paired sample t test was used to compare the effects of Fenugreek seed powder on biochemical parameters.

RESULTS

The mean age of subjects was 54.7±5.5, 56.0±7.7, 55.8±8.6 and 53.1±5.5 years in group 1, 2, 3 and 4 respectively. There were 6, 7, 9 and 10 males in group 1, 2 3 and 4 respectively. There was no significant difference in age and sex in different groups. No allergic reactions to fenugreek seed powder in the form of flatulence, diarrhea and dizziness was reported in our cohort of study.

Table 1 shows there was a significant reduction in FBS levels from the baseline values after 15th, and 30th day of fenugreek administration in group 1, 2 and 3. We found no significant difference in FBS levels from baseline values in group 4 i.e. in healthy subject.

Table.1: Blood sugar profile between four groups at different intervals of fenugreek seed powder administration

Parameters	Group 1	Group 2	Group 3	Group 4
FBS (0 day)*†	155.6±14.3	161.8±24.7	185.1±27.3	79.6±6.5
FBS (15th Day)*	138.8±12.5	143.3±36.0	155.2±36.9	78.1±5.0
FBS (30th Day)†#	125.7±16.0	138.6±31.5	147.7±28.4	77.4±5.8
FBS (45th Day)#	131.4±20.9	151.6±29.2	151.8±30.2	79.9±4.8
P Value*	<0.01	<0.05	<0.01	>0.05
P Value†	<0.001	<0.05	<0.001	>0.05
P Value#	<0.01	<0.05	<0.001	>0.05
PPBS (0 day) *†	274.4±22.9	226.2±24.6	234.2±24.3	106.07±10.5
PPBS (15th Day)*	228.3±32.3	207.3±23.0	226.0±38.8	104.6±8.5
PPBS (30th Day) †#	225.0±33.7	200.4±13.7	219.2±27.3	101.4±8.8
PPBS (45th Day)#	226.5±25.2	209.4±39.5	240.3±35.4	102.3±7.6
P Value*	<0.05	<0.05	<0.05	>0.05
P Value†	<0.01	<0.05	<0.05	>0.05
P Value#	<0.01	>0.05	>0.05	>0.05
HbA1c (0 day)	7.02±0.25	6.1±0.65	9.4±0.57	4.3±0.74
HbA1c (45th Day)	6.1±0.46	5.4±0.78	7.9±0.73	4.2±0.67
P Value	<0.001	>0.05	<0.001	>0.05

Similarly PPBS levels were also found significantly decreased from baseline in the 3 diabetic groups and were remain same in healthy groups after 15th and 30th day.

As the fenugreek seed powder administration was stopped at 30th day there was again increase in FBS and PPBS levels from 30th day to 45 days in group 1 and 3.

There were also decreased in HbA1c Levels after 45 days in group1 and group 3 but there was no change in Hb1Ac levels in group 2 as their baseline Hb1Ac levels were already in the range. There was also no change in HB1Ac Levels in Control Group.

We found no significant difference in liver function test (Serum bilirubin, alkaline phosphates ALP and SGPT), and renal function tests (blood urea, serum creatinine and serum Uric Acid) after 15, and 30 days (Table 2 and 3). However Total Cholesterol levels were decreased in diabetic groups (group 1, 2 and 3) after 30 days of fenugreek administration (Table 4).

Table.2: Liver function profile between four groups at different intervals of fenugreek seed powder administration

	Group 1	Group 2	Group 3	Group 4
S. Bill (o day) *†	1.15±0.4	1.35±0.6	0.092±0.3	0.94±0.19
S. Bill (15th Day) *	1.09±0.3	1.16±0.38	0.8±0.1	0.89±0.14
S. Bill (30th Day) †#	0.91±0.29	1.1±0.33	0.87±0.22	0.82±0.16
S. Bill (45th Day)	0.89±0.17	1.02±0.28	0.81±0.14	0.88±0.14
P Value*	>0.05	>0.05	>0.05	>0.05
P Value†	>0.05	>0.05	>0.05	>0.05
P Value	>0.05	>0.05	>0.05	>0.05
ALP (o day) *†	110.6±13	127.6±19	127.7±18	124.2±13.1
ALP (15th Day) *	104.9±10.7	113.1±21.7	112.7±17.1	122.3±11.7
ALP (30th Day) †#	108.3±19.1	118.6±18.6	112.7±17.6	127.1±8.7
ALP (45th Day)	112.1±16	123.4±18	118±19.9	125.2±11.1
P Value*	>0.05	>0.05	>0.05	>0.05
P Value†	>0.05	>0.05	>0.05	>0.05
P Value	>0.05	>0.05	>0.05	>0.05
SGPT (o day) *†	32.22±4.4	29.1±5.7	36.14±8.4	30.3±6.1
SGPT (15th Day) *	31.44±9.23	26.7±5.3	32.7±7.8	30.2±5.7
SGPT (30th Day) †#	28.55±5	27.5±4.9	32.8±8.7	30.3±5.5
SGPT (45th Day)	26±4.5	26.1±4.7	33.9±9.2	30.4±5.9
P Value*	>0.05	>0.05	>0.05	>0.05
P Value†	>0.05	>0.05	>0.05	>0.05
P Value	>0.05	>0.05	>0.05	>0.05

Table.3: Renal profile between four groups at different intervals of fenugreek seed powder administration

	Group 1	Group 2	Group 3	Group 4
UA (o day) *†	3.8±0.9	4.28±0.5	4.92±1.1	3.70±0.60
UA (15th Day) *	3.87±0.71	4.4±0.61	5.26±1.09	3.42±0.52
UA (30th Day) †#	3.67±0.83	4.49±0.56	5.17±1.09	3.50±0.41
UA (45th Day)	3.5±0.75	4.55±0.7	5.27±1.23	3.60±0.48
P Value*	>0.05	>0.05	>0.05	>0.05
P Value†	>0.05	>0.05	>0.05	>0.05
P Value	>0.05	>0.05	>0.05	>0.05
S.Cr (o day) *†	0.86±0.1	0.88±0.1	0.92±0.1	0.94±0.19
S.Cr (15th Day)	0.89±0.1	0.9±0.14	0.94±0.2	0.90±0.14
S.Cr (30th Day) †#	0.86±0.07	0.91±0.14	0.87±0.09	0.82±0.16
S.Cr (45th Day)	0.91±0.09	0.89±0.17	0.9±0.16	0.88±0.14
P Value*	>0.05	>0.05	>0.05	>0.05
P Value†	>0.05	>0.05	>0.05	>0.05
P Value	>0.05	>0.05	>0.05	>0.05
Urea (o day) *†	24.22±2.1	24.45±5	27.7±4.8	30.2±6.1
Urea (15th Day) *	24.77±2.27	25.7±4.71	29.9±7.51	30.0±6.0
Urea (30th Day) †#	24.11±2.8	24.7±5.6	28.4±5.07	29.3±5.7
Urea (45th Day)	25±2.4	25.2±4.5	28.7±5.22	29.3±5.5
P Value*	>0.05	>0.05	>0.05	>0.05
P Value†	>0.05	>0.05	>0.05	>0.05
P Value	>0.05	>0.05	>0.05	>0.05

UA= Uric Acid, S. Cr=Serum Creatinine

Table.4: Lipid profile between four groups at different intervals of fenugreek seed powder administration

Parameters	Group 1	Group 2	Group 3	Group 4
TC (o day) *†	196.0±31	190±25	207±23	182.3±18.7
TC (15th Day)*	193.1±20	181±16	186±53	180.4±16.9
TC (30th Day) †#	180.3±28	178±19	190±22	180.3±19.5
TC (45th Day)#	195.5±19	175±30	190±22	176.6±16.3
P Value*	>0.05	>0.05	>0.05	>0.05
P Value†	<0.05	<0.05	<0.05	>0.05
P Value#	>0.05	>0.05	>0.05	>0.05
TG (o day) *†	199.7±45	178±31	205±68	174.9±44.6
TG (15th Day) *	166.6±47	164±33	197±71	176.4±46.3
TG (30th Day) †#	163.7±39	166±33	200±64	178.0±38.0
TG (45th Day)#	192.8±40	175±40	186±56	175.4±37.8
P Value*	<0.01	>0.05	>0.05	>0.05
P Value†	<0.01	>0.05	>0.05	>0.05
P Value#	>0.05	>0.05	<0.05	>0.05
HDL (o day) *†	45±8.7	40.5±3	43±5.3	46.8±10.6
HDL (15th Day) *	50.1±14	41±3.6	42.4±5.5	44.3±11.4
HDL (30th Day) †#	50.1±12	42.8±3.7	41.9±5.8	49.1±13.1
HDL (45th Day)#	40.6±7.9	43.8±3	41.9±5.8	49.1±12.6
P Value*	>0.05	>0.05	>0.05	>0.05
P Value†	>0.05	>0.05	>0.05	>0.05
P Value#	>0.05	>0.05	>0.05	>0.05
LDL (o day) *†	111±35	112±23	131±29	100.2±18.7
LDL (15th Day) *	114.7±33	103±13	116±30	100.6±15.6
LDL (30th Day) †#	117±26	98±19	113±29	100.2±18.3
LDL (45th Day)#	122±14	93±24	113±29	98.9±20.2
P Value*	>0.05	>0.05	>0.05	>0.05
P Value†	>0.05	>0.05	<0.05	>0.05
P Value#	>0.05	>0.05	>0.05	>0.05

TC= Total Choelesterol, TG-Triglyceride, LDL=Low Density Lipoprotien, HDL= High Density Lipoprotien

DISCUSSION

Fenugreek has a long history of medicinal usage in aruvedic medicine. It has inferred from the observation that fenugreek seed powder, given in a dose of 15gm/day (5gm TDS) for 1 month to newly diagnosed diabetic patients, controlled diabetic patient with oral hypoglycemic drug, uncontrolled diabetic patient with oral hypoglycemic drug and, there was a profound decrease in fasting as well as post prandial blood glucose level.

Khosla et al (21) worked on effect of fenugreek on blood glucose in normal and diabetic rats and found a significant reduction in blood glucose levels in diabetic rats and the hypoglycemic rats and the hypoglycemic effect was doe related. Gupta el 2001(22) reported the results of a small randomized controlled double blinded trial to evaluate the effect of fenugreek seeds on glycemic control. They used fenugreek seed extract for 2 months in diabetic patients and found significant reduction in blood glucose levels.

Various studies of oral administration of fenugreek seed powder reveal no reports of side effect which are clinically significant. Few side effects have been reported when fenugreek powder used as recommended dose i.e. flatulence, diarrhea and dizziness (13, 20). Hypersensitivity reactions have also been reported including rhinorrhea, wheezing and fainting after inhalation of fenugreek seed powder (17).

Fenugreek cannot be used during pregnancy due to its potential uterine stimulating properties (oxytocic action) as observed in animal studies. Ingestion of Fenugreek during 3rd trimester of pregnancy can lead to false diagnosis of maple syrup urine disease.

In present study we reported no hepatic and renal toxicity of fenugreek seed with a dosage of 15mg/day. Sharma et al 1996 also shows no clinical hepatic, renal and haematological abnormalities after administration of fenugreek seed powder at a dose of 25mg/day for 24 weeks.

In conclusion, if fenugreek seed powder is given to type II diabetes mellitus patients it can work independently as hypoglycemic agent without oral hypoglycemic drug or the dose of oral hypoglycaemic drug can be reduced along with the use of fenugreek seed powder. However it should be avoided in pregnant women and asthmatic patients. A long term study is also needed to see the efficacy of fenugreek seed as hypoglycemic agent.

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