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Effectiveness of Oral Intake of Fenugreek Seed Powder among Patients with Type 2 Diabetes Mellitus

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Abstract:

Type 2 Diabetes Mellitus (T2DM) has taken a heavy toll on the global population affecting 451 million people. A quasi experimental study was conducted among 60 subjects with T2DM selected purposively with the objectives (i) to assess and compare the fasting blood sugar levels and self-reported health problems among type 2 diabetes mellitus patients in the experimental and control group before and after the administration of fenugreek seed powder and (ii) to find out the association between fasting blood sugar level and selected demographic variables. The data on fasting blood sugar was collected using with glucometer and health problems with a 3 point rating scale. Reliability and validity of instruments and ethical clearance were established prior to data collection. Descriptive and inferential statistics were used for analysis by SPSS version 20. Results: Among the experimental group, a highly significant ($t=9.974$) ($p<0.001$) reduction in the fasting blood sugar level was observed. Overall score of self-reported health problems did not differ between the experimental and control groups. Significant ($f=2.977$) ($p= 0.031$) association was found between Fasting blood sugar level and educational qualification among subjects from experimental group. The study results indicate that fenugreek seed powder was effective in controlling blood sugar levels in type 2 diabetes mellitus.

Keywords: Type 2 diabetes mellitus, fenugreek powder, fasting blood sugar

1. Introduction

Diabetes is the single most important metabolic disease which can affect nearly every organ and systems in the body. It is the most dangerous disease from which almost every country is suffering.ⁱ Global prevalence of diabetes was estimated to be 9% in 2014 among adults aged above 18 years.ⁱⁱ

Globally, as of 2010 an estimated 285 million people had diabetes with type 2 diabetes mellitus making up about 90% of the cases. The Western Pacific region and Europe have the highest number of people with diabetes, approximately 67 and 53 million respectively.ⁱⁱⁱ In developing countries, the majority of individuals with diabetes are aged between 45 and 65 years while in developed countries the majority are older than 64 years. The greatest increase in prevalence is expected to occur in Asia and Africa where most patients will probably be found by 2030.^{iv} Kerala is the diabetes capital of India with a prevalence of diabetes as high as 20%, double the national average of 8%. Several studies from different parts of Kerala support the high prevalence of diabetes.^v

The increase in incidence in developing countries follows the trend of urbanization and lifestyle changes perhaps the dietary effect of a highly "Western-style" diet. Hence the care of diabetic patients includes a change in their life style, where the diet plan represents an important pillar of care. Diabetes lead to macro vascular and micro-vascular complications over 10-20 years; damaging the major organs like the heart, blood vessels, eyes, kidneys, and nerves.² Although keeping diabetes mellitus under control is complex, good control significantly reduces the risk of complications.

Fenugreek is a plant, which is grown in Egypt, India and Middle East has been used since ancient times in Indian medicine to heal various body conditions and diseases.^{vi} Fenugreek contains alkaloids, including Triglonelline, Gentianine and Carpaine compounds. The seeds contain 4-hydroxyisoleucine a fibre, thought to delay gastric emptying, slow carbohydrate absorption, inhibit glucose transport and directly stimulate insulin.^{vii} Besides increasing the number of insulin receptors in red blood cells and improving glucose utilisation in peripheral tissues, it demonstrates potential anti-diabetes effects both in the pancreas and other sites.^{viii}

A cross sectional survey to estimate the prevalence of type 2 diabetes among adults of 20 years and above from urban community in Trivandrum city found overall prevalence was 16.3%. The age standardised prevalence was 13.7% in 30-64years. Greater prevalence was associated with advancing age, body mass index above 24.99, sedentary habits, serum total cholesterol > 239, serum triglycerides > 149, hypertension and smoking. Compared to non-diabetics (4.34 ± 0.53 mmol/L), diabetics had higher fasting plasma glucose values (8.87 ± 3.6 mmol/L). The study concluded that prevalence of type 2 diabetes among a group of urban residents in Trivandrum city in Kerala was very high.^{ix}

An experimental study was conducted at Srinagar, Kashmir among 42 patients with T2DM to test the effectiveness of fenugreek seed powder on their HbA1c levels. Subjects were divided in to 3 groups; group 1 & 2 were given fenugreek seed powder 10 and 20 grams per day respectively while group 3 had followed the prescribed diet and drug regimen. Baseline HbA1c was obtained for all groups and repeated at 6 weeks. Subjects were assessed every 2 weeks for clinical, dietary parameters and fasting blood sugar levels. In group 2, a significant ($p < 0.05$) drop in fasting sugar levels was observed while in group 1 & 3, the decrease was not significant ($p > 0.05$). The difference in HbA1c levels was statistically not significant ($p > 0.05$).^x

A study was conducted in USA, to assess the effectiveness of fenugreek on heartburn among patients with frequent heartburn. Subjects were given fenugreek product 30 minutes before meals daily for 2 weeks. Subjects experienced improvement after 2 weeks compared to baseline. The findings suggested that fenugreek was useful in relieving heartburn.^{xi}

In another study, to assess the effectiveness of fenugreek on cholesterol levels among patients with high cholesterol levels who were divided into 3 groups; group I received 50 gm placebo (25gm rice powder and 25gm Bengal gram powder) group II received 25gm placebo & and 25 gm fenugreek while group III received 50 gm fenugreek orally before lunch and dinner every day for 20 days. The administered fenugreek was powdered and extracted with hexane to remove its lipid content and with alcohol to remove the Saponins. Fasting serum lipid levels were assessed on 0, 10th and 20th days. No significant change in lipid profile was seen among subjects in group I. Subjects from groups II and III showed significant difference ($p < 0.05$) in their serum cholesterol, triglycerides and very density lipoprotein levels. The study findings indicate that Fenugreek seed powder if taken orally before food at 25 and 50 gm twice a day may lower the lipid levels in patients with hyperlipidemia.^{xii}

Fenugreek has a positive effect on health problems like indigestion, constipation, sore throat, inflammation, hair fall and on many other health problems. Fenugreek is easily available, accessible, affordable and amenable to all diabetic mellitus patients. Accordingly, the present study was aimed at generating knowledge about the effectiveness of fenugreek on control of diabetes mellitus and its influence on other health problems. Findings from the study on the effectiveness of fenugreek powder on blood glucose and other health problems which will be helpful for the needy people in the society.

Objectives were (i) to assess and compare the fasting blood sugar level and the self-reported health problems among patients having Type 2 Diabetes Mellitus before and after the administration of fenugreek seed powder in experimental and control groups and (ii) to find the association between the fasting blood sugar level and their selected demographic variables before the intervention. Stated Hypotheses were: **H₁** There will be a significant difference between the mean FBS value of subjects in the experimental group and control group after the administration of fenugreek seed as measured using a glucometer. **H₂** There will be a significant difference in the mean scores of self-reported health problems of subjects in the experimental and control groups after the administration of fenugreek seed powder. All hypotheses were tested for significance at $p < 0.05$.

2. Methodology

A quasi experimental, non-equivalent control group pre-test post-test design was adopted. From two rural community health centres in Idukki, 60 subjects with T2DM were selected by purposive sampling. Patients with T2DM, having FBS > 120 mg% receiving oral hypoglycaemic agents between the age 35 to 75 years were included. Those with renal, cardiovascular and respiratory problems and pregnant or lactating mothers were excluded.

A standardized glucometer, demographic (5 items), disease related variables (7 items), and dietary pattern (4 items) and a 3 points rated health problem inventory with 15 items to get a score range of 0 to 30 were developed, validated and tested for reliability ($r = 0.81$) and was translated to local language prior to data collection. Ethical clearance and consent from subjects were obtained.

Pre-test was administered to control group including FBS levels and was followed by post-test after 28 days. Experimental group was administered pre-test and were given packets with 10gm fenugreek seed powder. They were instructed to consume the fenugreek seed powder before breakfast after mixing it in one glass of boiled cooled water continuously for 28 days. Subjects were regularly contacted to ensure follow up by direct visit or by phone calls. Post-test was taken after 28th day using the same tools. Data was analysed on SPSS 20.

3. Results

3.1. Section-I. Demographic Characteristics of the Sample

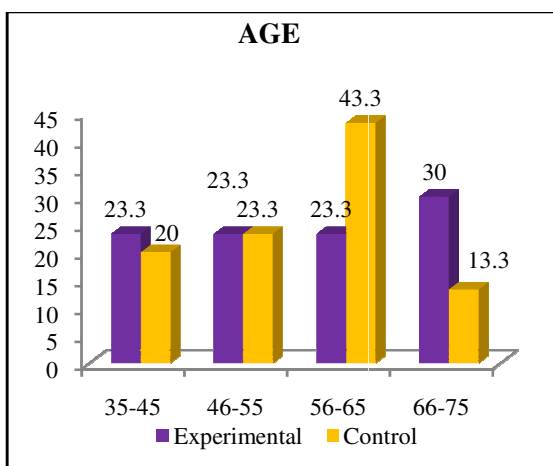


Figure 1: Distribution of subjects by Age

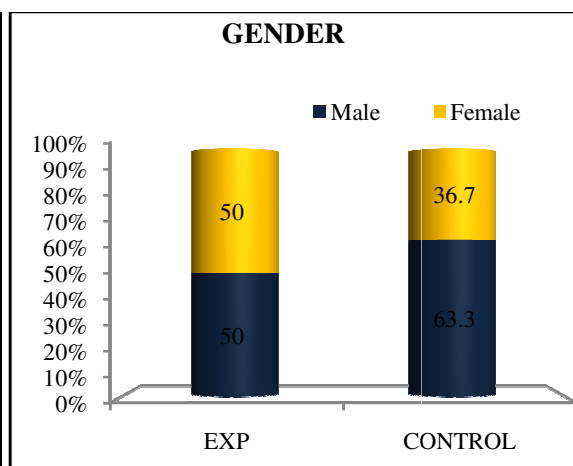


Figure 2: Distribution of subjects by Gender

Majority (43.3%) subjects in control group belonged to 56-65 years age group (Figure 1) Gender wise, experimental group had 50% male and females while in control, males were affected more (63.35%) (Figure 2)

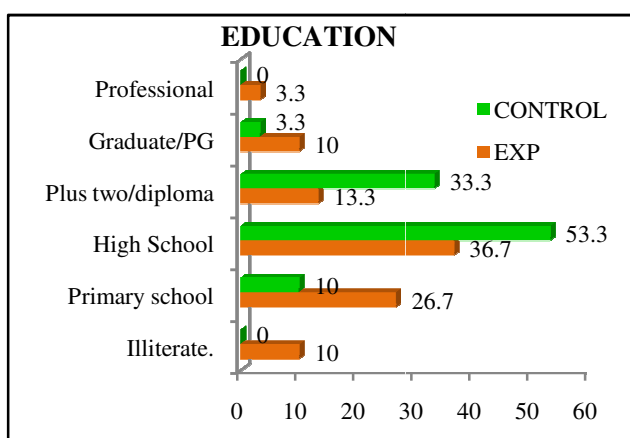


Figure 3: Distribution (%) of subjects by Education

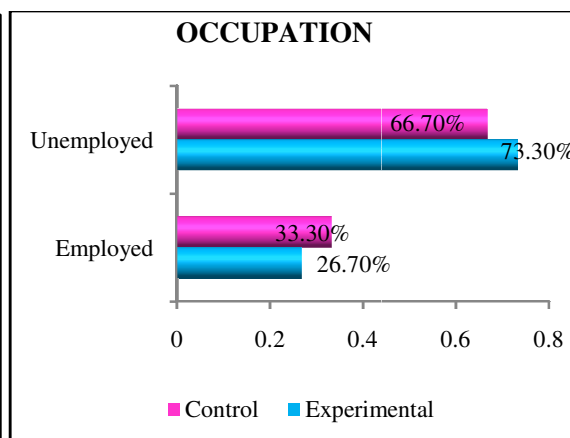


Figure 4: Distribution of subjects by Occupation

Majority subjects were educated up to high school or plus two; while 10% were illiterate in experimental group. Around 3.3% subjects in control and 10% in experimental group were graduates. Overall educational status was low among the sample (Figure 3). Majority (73.3%) subjects in experimental group and 66.7% subjects in control group were unemployed (Figure 4).

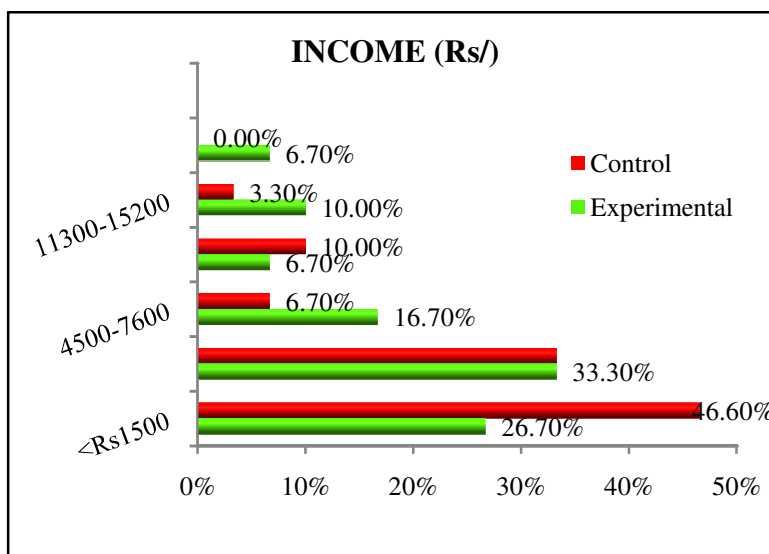


Figure 5: Distribution of subjects showing income group wise

3.2. Section-II Disease Related Findings

Majority subjects belonged to low income (< Rs. 4500/month) in both groups, particularly subjects from control group while no one reported >Rs.30300/- month. In the control group 14(46.6%) had a monthly income < Rs. 1500/- and no one had more than Rs.15200/- as monthly income (Figure 5).

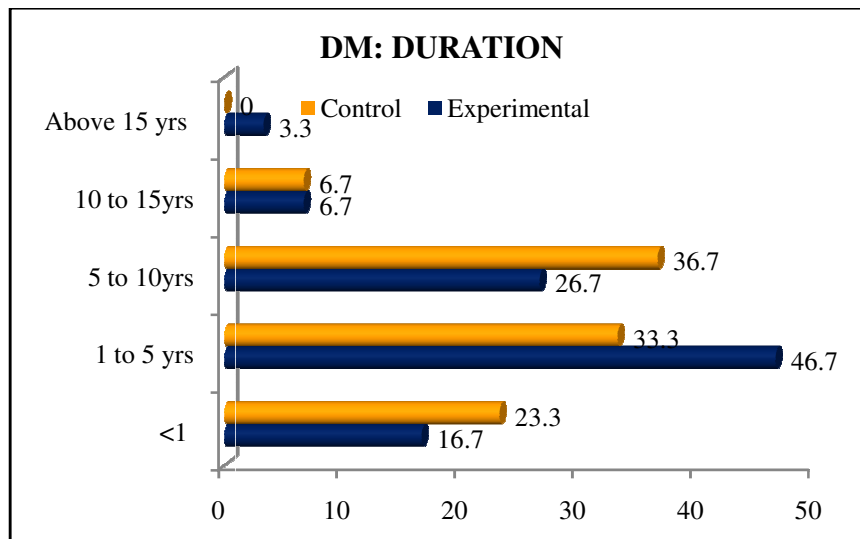


Figure 6: Distribution (%) of subjects showing duration of Diabetes Mellitus group wise

Majority (46.7%) subjects were suffering from DM for-1 to 5 years in experimental group whereas in control group, 36.7% had DM since 5 to 10 years. (Figure 6).

DM: Control Measures	Experimental group		Control group	
	f	%	f	%
Tablets	13	43.3	06	20.0
Tablets +diet	13	43.3	19	63.3
Tablet +Exercise	02	06.7	01	03.3
Diet + exercise	00	00.0	00	00.0
Tablet, Diet &Exercise	02	06.7	04	13.3

Table 1: Distribution of subjects according to Diabetes management group wise (N=60)

Majority subjects were managing their diabetes with tablets and diet in control (63.3%) and experimental groups (43.3%) or tablets alone. Nobody depended on diet& exercise alone to control DM. (Tab.1). Few subjects used combination of diet, exercise and tablets were only 6.7% in experimental and 13.3% in control groups (Table-1).

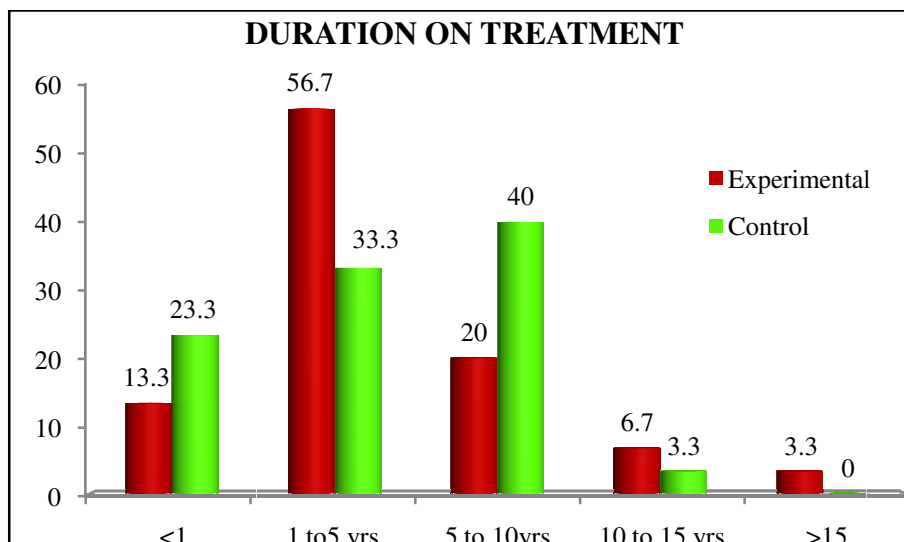


Figure 7: Distribution of subjects showing duration of treatment for DM

Majority (56.7%) subjects in experimental were on treatment for 1 to 5 years while in control group, 40% subjects were on treatment for 5 to 10 years. Subjects on treatment over 10 years were very few (6.7% experimental & 3.3% control) (Figure 7).

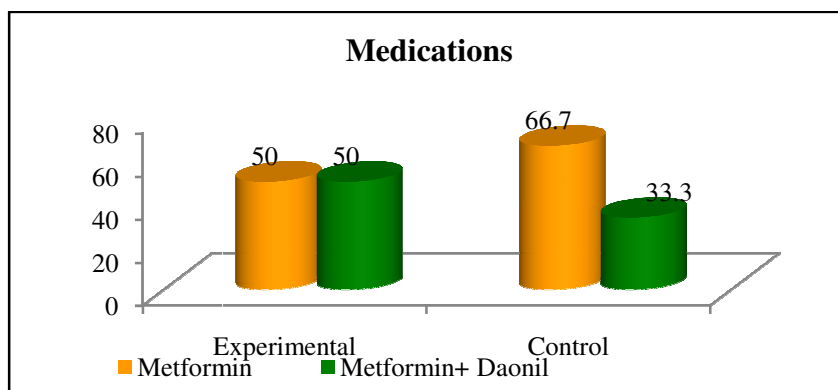


Figure 8: Distribution (%) of subjects according to medication therapy

Metformin was the drug used by majority subjects (control 66.7% & experimental 50%). In experimental group, 50% subjects were taking combination drugs of Metformin and Daonil tablets (Figure 8). Apart from this, lone subject in experimental group and 2 subjects among control group were taking alternative therapy for DM. In experimental group, 53.3% subjects were taking two tablets per day whereas in the control group 21(70%) subjects were taking only one tablet per day.

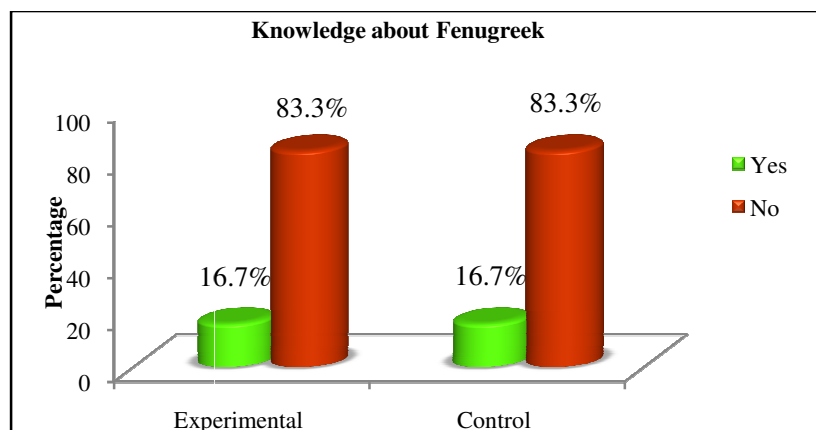


Figure 9: Distribution of subjects showing awareness about Fenugreek group wise

Majority (83.3%) subjects from both groups were unaware of fenugreek as a remedial measure for diabetes mellitus (Figure 9).

Variables	Characteristics	Experimental		Control	
		f	%	f	%
Food habits	Vegetarian	04	13.3	01	03.3
	Non vegetarian	26	86.7	29	96.7
Red meat	Daily	06	20.0	03	10.0
	Weekly	24	80.0	27	90.0
	Monthly	00	00.0	00	00.0
Fish	Daily	19	63.3	01	03.3
	Weekly	11	36.7	28	93.3
	Monthly	00	00.0	01	03.3
Egg	Daily	00	00.0	08	26.7
	Weekly	16	53.3	22	73.3
	Monthly	14	46.7	00	00.0

Table 2: Frequency and percentage distribution of subjects based on diet related variables in the experimental and control group. (N=60)

Food habits were mostly non vegetarian (control 96.7% & experimental 86.7%); only 13.3% experimental and 3.3% control group subjects reported vegetarian food habits. Among non-vegetarians, daily intake of red meat and fish was high among subjects in both groups. Intake of red meat was considerably frequent in both groups; 20% subjects in experimental group had and 80% subjects consumed red meat weekly while 10% subjects in control group had daily and 90% subjects had red meat weekly once. More (93.3%) subjects in control group consumed fish weekly against 36.7% in experimental group. Intake of egg was also high among control group subjects than among experimental group (table-2).

3.3.1. Section-IIIa. Findings related to Fasting Blood Sugar levels and health related problems before and after Fenugreek administration among subjects with Type 2 Diabetes Mellitus.

During pretest, entire 30 (100%) subjects in experimental group had FBS >130mg% while in control group, 29(93.3%) had FBS >130mg%. During post-test in experimental group, 4(13.3%) subjects had FBS between 70 to 110mg% and 7(23.3%) had between 110-130mg% and only 19(63.3%) had FBS >130mg%. In control group, 28(93.3%) subjects had FBS >130mg% while 2(6.6%) had FBS between 110-130mg% (Table-3).

FBS mg%	Experimental				Control			
	Pretest		Post test		Pretest		Posttest	
	f	%	f	%	f	%	f	%
70 -110	00	00	04	13.3	00	00.0	00	00.0
110-130	00	00	07	23.3	01	03.3	02	06.6
>130	30	100	19	63.3	29	96.6	28	93.3

Table 3: Distribution of subjects with T2DM showing FBS levels before and after Fenugreek administration in experimental and control groups (N=60)

H₁. There will be a significant difference between the mean FBS value of subjects in the experimental group and control group after the administration of fenugreek seed as measured using a glucometer at 0.05 level of significance.

Group	Fasting Blood Sugar (mg %)		Meandifference	Paired t-value	df	p-value
	Pre	Post				
	Mean ± SD					
Experimental	164.4±26.38	140.4±27.51	23.500	9.974	29	0.000***
Control	164.3±31.29	153.1±25.77	11.133	0.681	29	0.072 ^{NS}

Table 4: Comparison of FBS levels between pretest and posttest among subjects in experimental and control group.

***Significance at $p < 0.001$ ^{NS} No Significance $p > 0.05$

A highly significant ($p < 0.001$) was observed between the pretest and posttest Fasting Blood Sugar (FBS) values of subjects among experimental group who received Fenugreek. In control group on significant difference was observed between pretest and posttest FBS values ($p > 0.05$) (Table-4). Thus from the findings it can be inferred that Fenugreek seeds reduce FBS levels in patients with Type 2 DM. Hence the research hypothesis **H₁** was accepted.

3.3.2. Section-IIIb: Self-reported health problems of type 2 diabetes mellitus patients in the experimental and control group before and after the intervention.

Self-reported Health problems	Experimental group		Paired t-value	df	P value
	Pre-test	Post-test			
	Mean ±SD				
Indigestion	0.77±0.68	0.53±0.51	5.635	29	0.090
Heartburn	0.77±0.68	0.53±0.51	2.536	29	0.017*
Constipation	1.07±0.87	0.70±0.88	3.003	29	0.055
Pruritis	0.57±0.77	0.37±0.49	2.693	29	0.012*
Excess appetite	1.37±1.30	0.93±0.87	3.791	29	0.001***
Overweight	1.30±1.24	0.97±0.85	2.567	29	0.016*

Table 5: Comparison of pre-test and post-test self-reported health problem scores among subjects in experimental group

Self-reported Health problems	Control group		Paired t-value	df	P value
	Pre-test	Post-test			
	Mean ±SD				
Indigestion	2.97±1.50	3.70±1.60	-1.869	29	0.072
Heartburn	0.53±0.63	0.77±1.28	2.804	29	0.089
Constipation	0.77±0.76	0.37±0.88	2.262	29	0.031*
Pruritis	0.17±0.46	0.13±0.35	0.571	29	0.573
Excess appetite	1.40±0.86	1.27±0.83	1.072	29	0.293
Overweight	1.53±1.11	1.30±1.15	0.942	29	0.354

Table 6: Comparison of pre-test and post-test self-reported health problem scores among subjects in Control group

Highly significant ($p < 0.001$) was observed between pre-test and post-test scores for excess appetite and significant differences ($p < 0.05$) for heart burn, pruritus and overweight among subjects in experimental group who received fenugreek (Table-4).

In Control group subjects, significant ($p < 0.05$) difference was noted in terms of constipation only while the remaining health problems did not show any significant differences ($p > 0.05$) (Table-5).

The findings indicate that fenugreek is effective in controlling health problems associated with T2DM (Table-4). Hence the Hypothesis H_2 was accepted.

Variables	Experimental		Control	
	f-value	p-value	f-value	p-value
Age	1.153	0.346	2.033	0.134
Gender	1.836	0.077	0.154	0.879
Education	2.977	0.031*	1.962	0.145
Occupation	0.580	0.567	0.215	0.831
Monthly income	0.239	0.942	0.513	0.727

Table 7: Association between Fasting Blood Sugar levels and selected demographic variables of subjects in experimental and control groups. (N=60)

A significant ($p < 0.05$) association was observed between education and FBS levels among subjects in experimental group while age, gender, occupation or income showed no significant association in either groups.

4. Discussion

Present study found equal number of females and males in experimental group whereas in control group, majority were males. Contrary to this, a study from Kashmir had females subjects were more.^{xiii}

Present study found majority subjects had high school education more in control group than experimental group. The findings are supported by a Jordanian study where majority subjects were high school educated.^{xiv} Education was found to have a significant association with blood sugar control. The findings underline the pivotal role of education in diabetes control.

It was striking to note that dietary habits in both groups were mostly non vegetarian; consisting of red meat consumption almost daily or weekly. Fish intake was high among both groups particularly in experimental group; 63.3% consumed daily and 36.7% consumed weekly. While in control group, 93.3% consumed fish weekly only. Red meat consumption within a 4 year period was reported to be associated with a higher risk of T2DM in the subsequent four years. Limiting red meat was associated with lower incidence of T2DM.^{xv} Eating processed meat was reported to be associated with 42% higher risk of heart disease and a 19% higher risk of type 2 diabetes.^{xvi} In the present study, majority subjects consumed red meat daily or weekly supported this.

Systematic analysis of 10 clinical trials to control diabetes with medium or high dose of using fenugreek seeds found significant reduction in 2 hour post prandial blood sugar and HbA1C levels.^{xvii} In another study, subjects who received fenugreek 10md per day and regular treatment for diabetes found no significant reduction in FBS whereas the group who received 20gm fenugreek per day was found to have significant reduction in FBS levels.^{xviii}

Present study found significant ($p < 0.001$) differences in terms of excess appetite, overweight, pruritus, heart burn ($p < 0.05$) and constipation ($p = 0.05$) after the intake of fenugreek seed powder for 28 days. Fenugreek administration for a longer period more than 4 weeks might have shown more convincing results. This findings are supported by the literature on fenugreek.

The presence of the natural fiber galactomannan, in fenugreek slows down the rate of sugar absorption into bloodstream. Amino acid (4-hydroxyisoleucine) in fenugreek induces the production of insulin so therefore, 15-20 grams of fenugreek is recommended for controlling blood sugar on a daily basis.

Numerous health benefits of fenugreek are reported; relief from constipation, loss of taste, mouth ulcers, sore throat, anaemia, fever, muscle aches, skin conditions, dandruff, stomach disorders, respiratory disorders, diabetes, inflammations, wounds and insomnia. It suppresses appetite and is good for patients suffering from various kidney conditions. Fenugreek improves digestion, reduce cholesterol levels and protect heart health, while simultaneously boosting the immune system. Its antioxidant property helps in neutralizing free radicals, improving the body's overall metabolism and health. Besides, fenugreek has a wide variety of beneficial nutrients, including iron, magnesium, manganese, and copper, as well as vitamin B6, protein, and dietary fiber.^{xix}

5. Conclusion

The present study findings supports fenugreek seed powder as an effective measure in controlling blood sugar and health problems among subjects with type 2 diabetes mellitus. Significant association seen with fenugreek intake and relief of heartburn, pruritus, excess appetite, overweight and constipation among diabetic patients was encouraging. Nurses have a decisive role in creating awareness about the merits of fenugreek as a cost effective, easily available and accessible home remedy to control blood sugar and minor health problems that will enhance quality of life in diabetic patients.

6. Acknowledgements

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