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# COMPARATIVE ASSESSMENT OF TRIGONELLA FOENUM-GRAECUM & CINNAMON VERSUS SITAGLIPTIN ON GLYCEMIC CONTROL AND BODY WEIGHT IN TYPE 2 DIABETES: A RANDOMIZED CLINICAL TRIAL

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## ABSTRACT

**Background**. Metabolic syndrome and type 2 diabetes are growing health concerns worldwide, associated with increased risks of cardiovascular disease, kidney failure, and other complications. Conventional treatments like sitagliptin, a DPP-4 inhibitor, have shown efficacy in managing type 2 diabetes by improving glycemic control. However, there is a growing interest in exploring complementary and alternative therapies, including herbal remedies like Trigonella foenum-graecum (Fenugreek) and cinnamon, which have been traditionally used to manage blood sugar levels.**Objective**s: The purpose of the study is to assess the efficacy of sitagliptin and herbal drugs such as Trigonella foenum-graecum (Fenugreek) and cinnamon in treating patients with metabolic syndrome and type 2 diabetes. **Methodology** This prospective comparative study was conducted in the department of Medicine at Hamdard University Hospital (Taj Medical Complex) Karachi over a period of six months from July 23 to December 2023. Two hundred participants were selected and they were divided into two groups of one hundred participants each by a process of random sampling. Group A was given sitagliptin and the second group was given herbal medicine for 12 weeks. The efficacy of the two treatments was evaluated by measuring the Fasting Blood Glucose (FBS), Random Blood Glucose (RBS), Glycosylated Hemoglobin (HbA1c), Body Mass Index (BMI), and Waist-Hip Ratio on days 0, 30, 60 and 90 of treatment.. **Results:** The study demonstrated a statistically significant reduction in fasting blood sugar (FBS), random blood sugar (RBS), and glycated hemoglobin (HbA1c) levels in both the herbal and allopathic treatment groups. Notably, the herbal group, which received Trigonella foenum-graecum (Fenugreek) and cinnamon, showed superior efficacy by day 90 compared to the allopathic group. This suggests that the combination of Fenugreek and cinnamon could serve as a potential alternative or complement to conventional treatments for managing glycemic levels in patients with type 2 diabetes and metabolic syndrome.**Conclusions:** Based on the study's findings, it can be concluded that both sitagliptin and the herbal compound containing Trigonella foenum-graecum (Fenugreek) seed and cinnamon bark powder demonstrated potential benefits in managing patients with metabolic syndrome and type 2 diabetes. The herbal remedy showed promise in improving glycemic control and anthropometric parameters, although the magnitude of effects may vary compared to sitagliptin.

**Key Words:** Sitagliptin, Cinnamon, Trigonella foenum-graecum (Fenugreek), Metabolic syndrome, Type 2 diabetes

## INTRODUCTION

Metabolic syndrome and type 2 diabetes mellitus (T2DM) are closely linked conditions that independently increase the risk of cardiovascular disease. MetS is characterized by a cluster of metabolic abnormalities, including insulin resistance, central obesity, dyslipidemia, and hypertension, which collectively heighten the risk of developing T2DM and cardiovascular disease. The global prevalence of both MetS and T2DM has risen sharply in recent years, posing significant public health concerns. This underscores the urgent need for effective therapeutic strategies to mitigate these risks and improve health outcomes.( 1 ). Diabetes mellitus is a complex group of metabolic disorders marked by persistent hyperglycemia, resulting from defects in insulin secretion, action, or both. Type 2 diabetes, in particular, is closely linked to metabolic syndrome, sharing key pathophysiological features like insulin resistance and obesity. To ensure timely diagnosis and treatment, international health organizations such as the American Diabetes Association (ADA) and the World Health Organization (WHO) have established diagnostic criteria. According to the ADA, diabetes can be diagnosed based on the following criteria: a fasting plasma glucose level of 126 mg/dL or higher, a random plasma glucose level of 200 mg/dL or higher, or a glycated hemoglobin (HbA1c) level of 6.5% or higher (2). Metabolic syndrome is increasing in prevalence worldwide in adults, with present estimates around 20–25%.(3) Pakistan is also among the countries with high prevalence of MetS risk factors, including obesity, hypertension, and glucose intolerance. (4) Furthermore, epidemiological evaluations have also described an increased global burden of type 2 diabetes, with up to 10.5% of adults aged 20–79 years are diagnosed with the disease. (5)

Dipeptidyl Peptidase-4 (DPP-4) inhibitors are a widely used class of antihyperglycemic medications for managing type 2 diabetes. These drugs work by inhibiting the DPP-4 enzyme, which breaks down incretin hormones like glucagon-like peptide 1 (GLP-1) and gastric inhibitory peptide (GIP). By preventing their degradation, DPP-4 inhibitors like sitagliptin promote insulin secretion and reduce glucose levels, helping maintain proper glucose homeostasis. Sitagliptin, in particular, is a highly selective DPP-4 inhibitor with a long half-life and high oral bioavailability, making it a popular choice within this drug class. (6)

There's growing interest in companies focused on alternative and complementary medicine, particularly those offering herbal preparations derived from plants, fungi, algae, and lichens as dietary supplements. Notably, some modern medications are developed from bioactive compounds found in traditional remedies, highlighting the potential benefits of exploring natural sources for therapeutic applications and its associated metabolic disorders.(7) Fenugreek, a succulent plant of the Fabaceae family, is indigenous to various regions such as India, China and North Africa. It's antidiabetic property have been attributed mainly to diosgenin, 4-hydroxyisoleucine and its fiber. The suggested mechanisms of action of fenugreek are an increased regeneration of pancreatic β cells, an improvement in insulin secretion and more responsiveness to glucose, improved insulin dependent glucose utilization and reduction in insulin resistance in tissues like muscle and liver. (8)

Recent clinical trials have also studied the blood glucose and lipid-lowering effects of fenugreek (Trigonella foenum-graecum). Meta-analysis of RCTs have shown that fenugreek reduces fasting plasma glucose (FPG), HbA1c, insulin resistance (HOMA-IR), total cholesterol, low-density lipoprotein (LDL) cholesterol, and body mass index. Moreover, the HDL cholesterol significantly increased following fenugreek treatment in subjects with T2 DM. (9)

One of the spices that come from the genus Cinnamomum in Lauraceae family, of which more than 250 species are poets. Its antidiabetic properties have been brought to light both in laboratory and human studies. (10) The active ingredient causing this effect is cinnamaldehyde. The mechanisms

of action of cinnamon are through potentiation of insulin function with activation of PPAR, inhibition of genes associated with liver gluconeogenesis, and production of lipid. (11)
Although some existing evidence in favor of fenugreek and cinnamon with regard to efficacy exists, there are still scanty of active comparative studies pitting these medicinal plants against sitagliptin. Under these circumstances this study attempts to bridge this research gap by comparing the glycemic and metabolic responses between sitagliptin as well as fenugreek and cinnamon in patients with MetS having T2DM. With the compilation of the contemporary clinical evidences, this review attempts to reflect on how these herbals could act as options or supplements to tradition pharmacotherapeutics.

**OBJECTIVES**

The objective of this study is to evaluate and compare the efficacy of sitagliptin (a DPP-4 inhibitor) with an herbal compound containing Trigonella foenum-graecum (Fenugreek) seed and cinnamon bark powder in managing patients with metabolic syndrome and type 2 diabetes. Specifically, the study aims to assess the impact of these interventions on glycemic control, as measured by fasting blood sugar (FBS), random blood sugar, and glycated hemoglobin (HbA1c) levels. Additionally, the study will examine the effects on anthropometric parameters, including Body Mass Index (BMI) and Waist:Hip ratio, to gain a comprehensive understanding of the therapeutic benefits of these treatments.

**METHODOLOGY:**

This a 12-week Randomized clinical trial conducted at the Hamdard University Hospital (Taj Medical complex) Karachi, Pakistan, from July 2023 to November 2023 in which total of 200 patients were enrolled which has 41% male ,59% female. Which randomly assigned to two treatment groups i.e. allopathic and herbal. Each group consists of 100 patients. The study consisted of two groups: Group A, which received Sitagliptin with Metformin and Group B which received herbal treatment ( Trigonella foenum-graecum (Fenugreek) and cinnamon powder). Patients in Group A were administered Tab. Sitagliptin 50 mg and Tab. Metformin 500 mg orally twice daily for 12 weeks. In contrast, patients in Group B were given an herbal compound containing 3gm of Trigonella foenum-graecum (Fenugreek) seed and 3gm of cinnamon bark powder once daily for the same duration (12).Patients in both groups were followed up monthly for three months from the initiation of therapy.

During each follow-up visit, fasting blood sugar (FBS) and random blood sugar levels were recorded. Additionally, glycated hemoglobin (HbA1c), Body Mass Index (BMI) and Waist:Hip ratio were measured at the initial visit and after 12 weeks of treatment. This comprehensive evaluation allowed for a thorough assessment of the efficacy of both treatment regimens.

**Inclusion Criteria:**

1) Patients ageing between 35–65 years. 2) Patients with a diagnosis of metabolic syndrome according to the criteria of IDF 2005.

**Exclusion criteria:**

1) Pregnant & lactating female. 2) Use of insulin or sulfonamide derivative oral antidiabetic drugs. 3) Presence of liver or kidney disease, or immune deficiency. 4) Patients with history of cardiovascular diseases. 5) Patients with intellectual disability or psychiatric illness. 6) Any contraindication to the use of drugs involved in the study.

**Ethical approval**

Protocol approval was obtained from Ethical Review Board Hamdard University (ERB-HU) (Approval No. ERB:2023-18). Informed written consent was also obtained from all participants. The trial is registered with Clinicaltrials.gov (NCT06515652).

## STATISTICAL ANALYSIS

The sample size for the frequency of population was calculated by using the OpenEpi, Version 3. (Kelsey et al.) The data analysis was done using the SPSS version 25. All quantitative parameters such as RBS, FBS, hemoglobin A1c and body mass index (BMI) were presented in mean ± standard deviation (x ± s). The parametric t-test was performed to estimate the significant clinical difference between pre and post treatment findings. Count data expressed as percentage/rate and analyzed by using chi-square test. Level of significance was set at P-values less than 0.05.

## RESULTS:

### Baseline characteristics

Baseline characteristics and general data of the two treatment groups showed in table 1 with no significant difference (p>0.05).

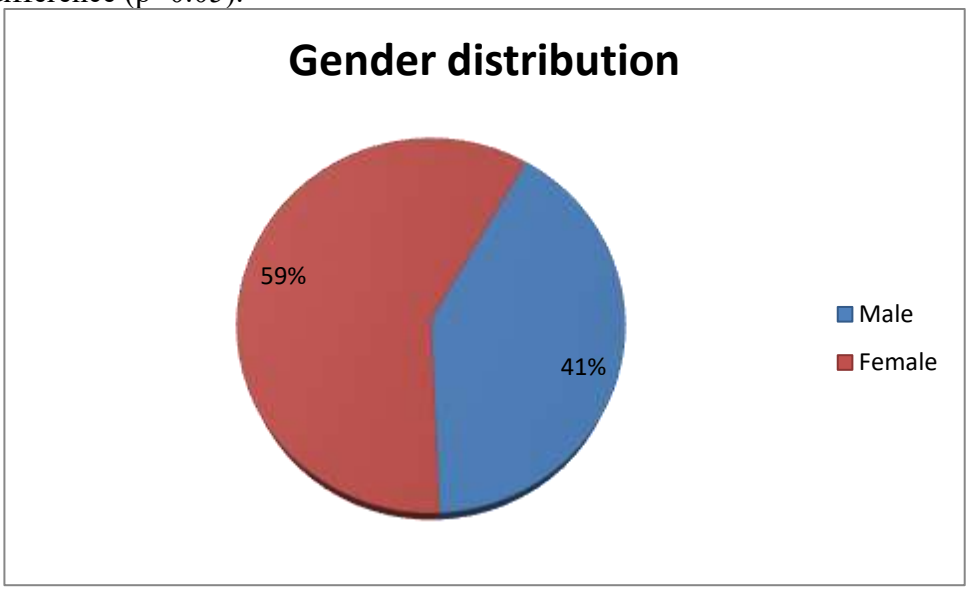


**Fig 1 showed the gender distribution of the participants**

**Table 1 showed the demographic details of the participants**

| | ALLOPATHIC GROUP (n=100) | HERBAL GROUP (n=100) | P value |
|---|---|---|---|
| AGE (Years) | 53.96 | 52.42 | 0.11 |
| Gender<br>Male Female | 44<br>56 | 38<br>62 | |
| BMI (Kg/m$^2$) | 30.02±3.47 | 30.12 ± 2.91 | 0.062 |
| W:H | 0.99 ±0.09 | 1.20 ± 0.12 | 0.10 |
| FBS (mg/dl) | 161.81 ± 27.239 | 159.18 ± 22.898 | 0.190 |
| RBS (mg/dl) | 248.91 ± 61.34 | 240.44 ± 51.79 | 0.091 |
| HbA1c (%) | 8.94 ±1.68 | 8.62 ±1.57 | 0.788 |

**Table 2 showed the comparison of Fasting Blood Sugar between different groups**

| Outcome Variable | Group statistics | | t (df) | p-value |
|---|---|---|---|---|
| | Groups | Mean ± Std. Deviation | | |
| FBS (Day 0) | Allopathic | 161.81 ± 27.239 | 4.42 (200) | 0.190 |
| | Herbal | 159.18 ± 22.898 | | |
| FBS (Day 30) | Allopathic | 148 ± 17.35 | 5.90 (200) | 0.000* |
| | Herbal | 142 ± 17.56 | | |

| | | | | |
|---|---|---|---|---|
| FBS (Day 60) | Allopathic | 123.78 ± 15.67 | 7.21 (200) | 0.035* |
| | Herbal | 112.43 ± 16.19 | | |
| FBS (Day 90) | Allopathic | 98.4 ± 9.81 | 8.52 (200) | 0.000* |
| | Herbal | 95.55 ± 7.22 | | |

On comparision of the Fasting Blood Sugar (FBS) between the Allopathic and Herbal treatment groups over 90 days. All the outcome variables are presented using Mean ± SD at four time points, namely Day 0, Day 30, Day 60, and Day 90. It also includes the t-test results which were independent t-tests and the details were the values of t, degrees of freedom, and p-value on a mean difference for each of the two groups (Table 2)

At the start of the study the FBS of Allopathic group (161.81 ± 27.239) and Herbal group (159.18 ± 22.898) were not statistically significant (p = 0.190).On the 30th day of the study, the FBS of Allopathic group (148 ± 17.35) was higher than the FBS of the Herbal group (142 ± 17.56) and the difference in mean was 6.0 (p = 0.000).The reduction in the FBS of the Herbal group was found to be highly The mean values of the Allopathic and Herbal groups were 123±15.67 and 112±16.19 respectively and the difference between them was 11.35 (p=0.035). Also, at day 90, the FBS of Allopathic group was slightly high 98.4 ± 9.81 mg/dL as compared to Herbal group with 95.55 ± 7.22 mg/dL and the difference was 2.9 mg/dL.

**Table 3showed the Comparison of Random Blood Sugar between different groups**

| Outcome Variable | Group statistics | | t (df) | p-value |
|---|---|---|---|---|
| | Groups | Mean ± Std. Deviation | | |
| RBS (Day 0) | Allopathic | 248.91 ± 61.34 | 2.24 (200) | 0.091 |
| | Herbal | 240.44 ± 51.79 | | |
| RBS (Day 30) | Allopathic | 231.31 ± 48.23 | 3.57 (200) | 0.001* |
| | Herbal | 205.36 ± 44.31 | | |
| RBS (Day 60) | Allopathic | 178.11 ± 37.14 | 9.12 (200) | 0.000* |
| | Herbal | 170.45 ± 45.08 | | |
| RBS (Day 90) | Allopathic | 172.47 ± 26.24 | 6.54 (200) | 0.011* |
| | Herbal | 159.76 ± 24.52 | | |

On comparision of the Random Blood Sugar (FBS) between the Allopathic and Herbal treatment groups over 90 days. The data are described by Mean ± SD at four time points including Day 0, Day 30, Day 60, and Day 90 for every outcome measure (Table 3).
As for RBS, there was no difference between both groups at the beginning of the study; the Allopathic was 248.91 ± 61.34 and Herbal was 240.44 ± 51.79, p = 0.091. However, at day 30 the RBS of the herbal group (205.36 ± 44.31) was reduced significantly as compared to the Allopathic group (231.31 ± 48.23) with mean difference of 25.95 (p = 0.001) The herbal group attained a significantly low RBS by Day 60 (170.45 ± 45.08) as compared to the Allopathic group (178.11 ± 37.14) with a mean difference of 7.66 (p = 0.000). In the same manner, at day 90 the mean RBS of the herbal group was lower than that of the Allopathic group with the mean difference of 12.7 (p = 0.011) 159.76 ± 24.52 and 172.47 ± 26.24.

**Table 4 showed the Comparison of HbA1c levels between different groups**

| Outcome Variable | Group statistics | | t (df) | p-value |
|---|---|---|---|---|
| | Groups | Mean ± Std. Deviation | | |
| HbA1c (Week 0) | Allopathic | 8.94 ±1.68 | 7.17 (200) | 0.788 |
| | Herbal | 8.62 ±1.57 | | |

| | | | | |
|---|---|---|---|---|
| HbA1c (Day 90) | Allopathic | 6.70 ± 1.26 | 7.92 (200) | 0.000* |
| | Herbal | 6.61 ± 0.49 | | |

On comparision of the HbA1c between the Allopathic and Herbal treatment groups over 90 days. Data are presented as Mean ± SD at four time points i.e., Day 0, Day 30, Day 60, and Day 90 for each outcome variable (Table 4).

At day 0 the Hba1c levels showed no significant difference in means between Allopathic group (8.94 ± 1.68) and Herbal group (8.62 ± 1.57), p = 0.788. However, the reduction in Hba1c of the herbal group was slightly more (6.61 ± 0.49) than in the Allopathic group (6.70 ± 1.26), with a mean difference of 0.09 (p = 0.000).

In all, the herbal group showed significantly greater reductions in FBS, RBS, and HbA1c compared to the Allopathic group, as indicated by the significant mean differences at most of the time points.

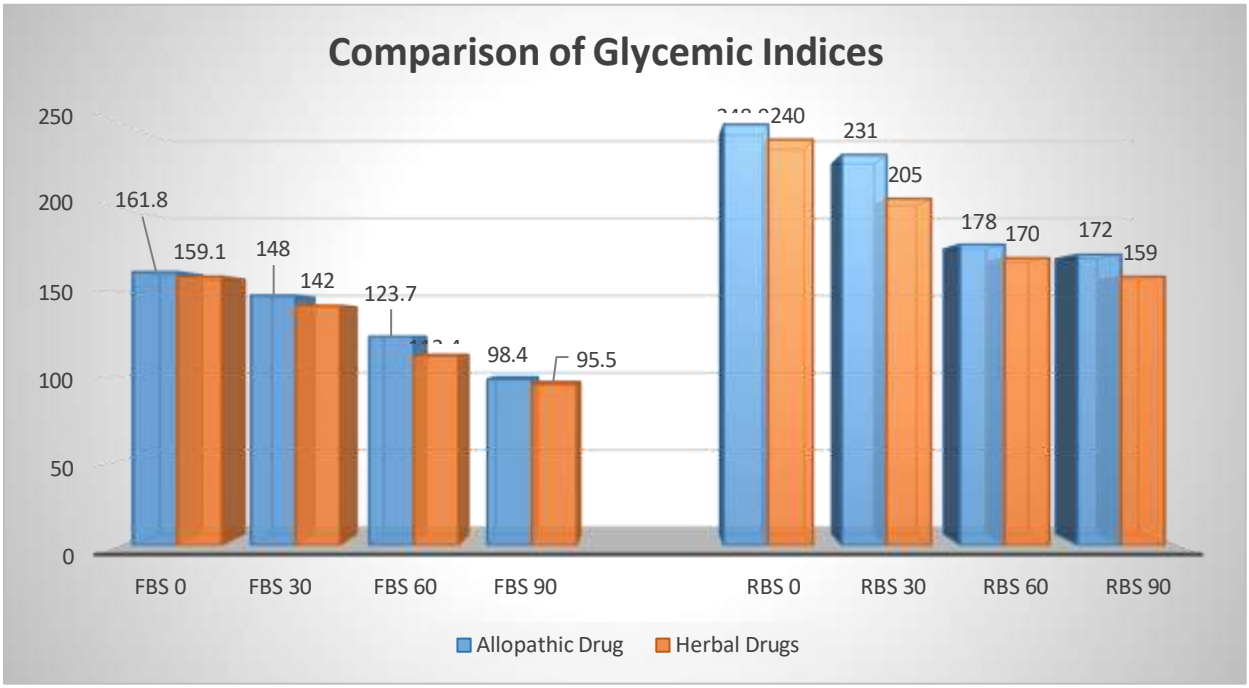


**Figure2 showed the comparision of glycemic index between different groups**

**Table 5: Comparison of BMI and waist hip ratio between different groups**

| Outcome Variable | Group statistics | | t (df) | p-value |
|---|---|---|---|---|
| | Groups | Mean ± Std.Deviation | | |
| BMI (Day 0) | Allopathic | 30.02±3.47 | 1.11 (200) | 0.062 |
| | Herbal | 30.12 ± 2.91 | | |
| BMI(Day 30) | Allopathic | 29.42 ±3.40 | 3.52 (200) | 0.000* |
| | Herbal | 28.24 ±3.26 | | |
| BMI(Day 60) | Allopathic | 28.12 ±3.21 | 3.91 (200) | 0.000* |
| | Herbal | 27.54 ± 3.62 | | |
| BMI(Day 90) | Allopathic | 27.25 ±3.15 | 5.24 (200) | 0.022* |
| | Herbal | 26.32 ±3.04 | | |
| | | | | |
| WHR (Day 0) | Allopathic | 0.99 ±0.09 | 2.13 (200) | 0.10 |
| | Herbal | 1.20 ± 0.12 | | |
| WHR (Day 30) | Allopathic | 0.97 ±0.09 | 4.43 (200) | 0.000* |
| | Herbal | 0.93±0.02 | | |

| | | | | |
|---|---|---|---|---|
| WHR (Day 60) | Allopathic | 0.92 ±0.093 | 6.01 (200) | 0.000* |
| | Herbal | 0.88 ± 0.33 | | |
| WHR (Day 90) | Allopathic | 0.90±0.09 | 6.04 (200) | 0.000* |
| | Herbal | 0.86 ±0.08 | | |

In order to solve this problem, we evaluated the efficacy and safety of Sitagliptin and herbal agents in patients with T2DM with metabolic syndrome. Results indicate that both treatments have a significant effect on fasting blood glucose, random blood glucose, and HbA1c levels of hyperglycemic subjects after 3 months. Decrement in BMI and WHR of patients receiving herbal regimen was also noted.

The test results of BMI and WHR of the subjects showed that by using allopathic and herbal medicines for a period of 90 days. The t-tests were used to analyze the data in order to compare the findings between the two groups (Table 5).

As for the BMI, there was no statistically significant difference between the two groups at the beginning of the study (Day 0) ($p = 0.062$). Therefore, there was a significant difference from day 30, day 60 and day 90 with the p value of 0.000 and 0.000 at day 30 and 60 respectively and 0.022 at day 90. The findings of the present study indicated that the herbal treatment group had slightly less BMI ($26.32 \pm 3.04$) as compared to the allopathic group ($27.25 \pm 3.15$) at the end of the study period. The same observation was made in WHR for which showed an increasing pattern. At 0 Day the observed p-value was 0.10, while at Day 30 $p = 0.000$, $p = 0.000$ at Day 60 and $p = 0.000$ at Day 90, the herbal group had a comparatively lower WHR value. The mean WHR of the herbal group was $0.86 \pm 0.08$ on day 90, the mean WHR of the allopathic group was $0.90 \pm 0.09$. In essence, the observed changes show that the herbal group had greater decreases in both BMI and WHR compared to the allopathic treatment group within the 90-day intervention period.

## STUDY LIMITATIONS

This paper provides useful information on the comparative efficacy of sitagliptin and herbal medicines in T2DM with a background of MetS. However, several limitations should be mentioned, as they might influence the generalizability of the conclusions. Despite the fact that the participants number was 200, which corresponds to the minimum number for the selected design, this number can be considered as rather limited considering the variety of the diabetic population. This is because it becomes difficult to generalize the findings when there is a limited number of participants, especially when ethnicity, geographical location, and health care systems are taken into consideration. Also, all participants were identified from one clinical setting and this clinical setting mainly attends to persons from the same income level. This may reduce the generalizability of the findings to other populations because it increases the homogeneity of the sample. Thus, in the subsequent studies it is necessary to attract a larger number of participants, from different Centers, with different types of population, and with longer treatment periods. Such trials would assist in coming up with these findings at a national level and strengthen the clinical recommendations.

## DISCUSSION

Dipeptidyl peptidase-4 (DPP-4) inhibitors are the mainstay of treatment in T2DM, because of their effect on glycemic control. Interest: Sitagliptin, one of the well-known DPP-4 inhibitors is quite successful in achieving target glycemic levels in patients with T2DM for almost a decade. In study, it is reported that the Sitagliptin effect on HbA1c reduction will be 0.6-1.2% used as monotherapy or combination with other antidiabetic agents, metformin, and sulfonylureas. These decrements are particularly evident in those subjects with high baseline HbA1c levels, which places patients who fail to reach individualized HbA1c targets on oral agents, DPP-4 inhibitors, as an ideal option. (13)

Clinical evidence showed that Sitagliptin effectively decreases the blood glucose levels in patients with T2DM whether used alone or with others (e.g., metformin). This study demonstrated a

decrease in fasting blood sugar from 7.8% to 7%, and a reduction of 1.3 mmol/L in the fasting blood sugar. These gains are clinically important providing significant protection against complications like diabetic retinopathy, nephropathy, and cardiovascular disease. Sitagliptin is free of the common diabetes drug side effect of weight gain. (14) Along the same line, a 24-week randomized clinical trial reported significant decreases in both fasting plasma glucose (from 152.1 to 137 mg/dL) and HbA1c (from 7.8% to 6.9%) in Sitagliptin compared with Dapagliflozin. (15) Sitagliptin is also a met-gliptin with minimal risk of hypoglycemia and has the benefit of being an appropriate agent among elderly and patients with renal impairment. Again, in another study by the same author Sitagliptin was added to conventional antidiabetic agents and fasting blood glucose and HbA1c was decreased from 148.8 to 136.4 mg/dl and from 8% to 7.3%. (16)

Beneficial effects of Sitagliptin on glucose and lipid parameters are also seen in Pakistani patients. One study noted a decrease in fasting blood glucose from 156 to 130 mg/dL, and HbA1c from 7.9% to 6.1%. (17) In parallel, recent studies have emphasized the importance of herbal supplements such as fenugreek (Trigonella foenum-graecum) and cinnamon (Cinnamomic spp.), in the treatment of elements of metabolic syndrome in patients with T2DM. These botanical therapies are being used increasingly for their putative benefit in normalizing blood glucose and lipid profiles. Cinnamomum verum (cv, true cinnamon) has been well documented for its glucose-lowering effects particularly in those with T2DM. A recent meta- analysis showed that cinnamon treatment–particularly at doses of <1,200 mg/day–reduces fasting glucose, yet HbA1c was more effectively improved, which suggests benefitting the long-term glycemic control. (18)

Methi dana or Fenugreek seeds are popular due of their potent ability to regulate blood sugar in patients with diabetes. Fenugreek has been studied to be rich in soluble fiber and antioxidants, contributing in the management of blood sugar levels through delaying digestion and absorption of carbohydrates. This process prevents sudden spikes in blood sugar following meals, and is beneficial for treating type 1 and type 2 diabetes. (19)

Cinnamon has also been found to have a role in glucose regulation. In another work, type 2 diabetic patients (with BMI also below and above 27) received 500 mg of cinnamon capsules (twice daily) for 3 months had substantial decrease on postprandial blood glucose levels after 2 h of eating (20). In another random clinical experiment, cinnamon supplementation improved blood sugar levels in prediabetes patients with obesity. (21) Also, the meta-analysis showed that cinnamon is effective in decreasing FBS level and IR in patients with T2DM and prediabetes. (22) Additional studies have confirmed that cinnamon has a significant effect on fasting blood sugar (FBS), random blood sugar (RBS), and HbA1c in people with type 2 diabetes. (23)

Fenugreek (Trigonella foenum-graecum) is a popular herbal supplement. Many trials have studied its impact on glycemic control and most indicate that fasting blood glucose levels decrease significantly with the use of cinnamon. In a rat model, diabetic rats given fenugreek for four weeks had significant reductions in fasting blood sugar. (24) A human trial which compared 154 patients with type 2 diabetes who received either a placebo or twice-daily fenugreek extract for 90 days noted a significant reduction in both fasting and postprandial blood glucose (25)

For example, one research found a synergistic effect when 10 grams of fenugreek seeds were consumed each day in combination with a controlled diet and regular exercise was utilized for at least six months. Fasting blood sugar decreased from 154.22 to 112.21 mg/dL while HbA1c improved from 7.2% to 5.78% with p-value of <0.001. (26)

Earlier evidence has been reported on the beneficial effects of Fenugreek via polyherbal formulations including it along with other botanicals like Aloe vera, Plantago psyllium, Allium

sativum, Nigella sativa, Silybum marianum. These regimens were also effective in decreasing HbA1c, fasting glucose, triglyceride, and LDL cholesterol in patients with type 2 diabetes. In another study in rats, FBS and HbA1c reduced from 162 to 142 mg/dl and from 8.4% to 7.7%, respectively, after 40 days of treatment. (27) A study with Iranian patients with T2DM using 5 g of fenugreek seed powder twice a day for two months showed a significant decrease in FBS, HbA1c, waist circumference, and BMI. 149.74 to 126.59 mg/dL for FBS, 7.96% to 7.46% for HbA1c, 26.64 to 25.75 kg/m² for BMI), 98.05 to 94.87 cm for waist circumference,
respectively. The author proposed fenugreek as adjunctive nutritional supplement for regulating blood glucose level in diabetic patients. (28)

In our trial, there was a statistically significant decrease of 9.2% in BMI from baseline to the weight reduction period in subjects taking the herbal treatment. In contrast, although Sitagliptin, DPP-4 inhibitor, has been one of effective medications for better control of glycemia by increasing insulin secretion and reducing glucagon secretion, there has been limited action of Sitagliptin on BMI in MetS patients. (29)

In a large RCT, Sitagliptin demonstrated significant reductions in HbA1c but was not associated with significant effect on body weight. Body Mass Index (BMI) showed minor reduction from 70.1 and 69.5 kg/m² after 24 weeks of 50 mg daily dose of Sitagliptin. This may indicate that although Sitagliptin controls glucose level in the blood, it does not enhance weight or BMI. (30)

## CONCLUSION

The results of the study on the effectiveness of Sitagliptin and herbal therapies for patients with type 2 diabetes with metabolic syndrome show that the herbal treatments are more effective in lowering FBS, RBS, and HbA1c. Nevertheless, Sitagliptin also helps in glycemic control but it is less effective in the management of body weight than the herbal interventions, which is an essential consideration given the high obesity levels among this group of patients.
Consequently, it can be suggested that Trigonella foenum-graecum (Fenugreek) and cinnamon might be useful as the adjuvant therapies for patients with diabetes and other metabolic complications. But those people who want to use these herbal remedies, should do it only after consulting the doctor, to avoid possible side effects and interactions with the prescribed antidiabetic drugs.

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