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Research Article

# The Efficacy and Safety of Teneligliptin and Metformin versus Glimepiride and Metformin in Patients of Type-2 Diabetes Mellitus Uncontrolled with Monotherapy

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## ABSTRACT

**Introduction:** Type 2 diabetes mellitus is one of the most common non-communicable diseases associated with short term and long term complications.

**Material and methods:** A total of 60 patients were included in the study divided into 2 groups of 30 patients each. Group 1 patients were given Teneligliptin 10 mg once a day and metformin 500 mg twice a day after meals for 12 weeks. Group 2 patients were given Glimepiride 1 mg once a day and metformin 500 mg twice a day after meals for 12 weeks. After the written consent, history, clinical examination, biochemical investigations including FBG, PPBG, HbA1c and lipid profile were done. Repeat FBG and PPBG were done every week upto 12 weeks. HbA1c and lipid profile were done at the beginning and at the end of study.

**Results:** Change in FBG was more in group 1 as compared to group 2. On comparison of reduction in change in PPBG in patients of group 1 versus group 2, there was a highly significant reduction in group 1. Change in HbA1c, total cholesterol levels, triglyceride levels, HDL and LDL was more in group 1 than in group 2.

**Conclusion:** Teneligliptin and metformin caused a greater improvement in glycaemic and lipid profile as compared to Glimepiride and metformin. Thus teneligliptin is more efficacious than glimepiride.

**Keywords:** Teneligliptin; Metformin; Glimepiride; Type-2 diabetes mellitus; Monotherapy

## INTRODUCTION

Type 2 Diabetes (T2D) is the rapidly growing epidemic in India. Epidemiological estimates suggest that currently 69.2 million people have diabetes, 36.5 million have Impaired Glucose Tolerance (IGT), and 3.6 million are probably undiagnosed with T2D [1]. This colossal prevalence of diabetes stresses on appropriate management of T2D.Uncontrolled diabetes due to under treatment or non-adherence to medication leads to serious complications and adverse clinical outcomes [2].

Amidst availability of multiple treatments, glycemia control to target levels is seen in 50% of the patients [3]. Targeting disease pathophysiology is essential for glycemic control in T2D. Dipeptidyl peptidase 4 inhibitors (DPP4i) are a new class of drugs which inhibit DPP4 enzyme leading to increased levels of Glucagon like Peptide-1 (GLP-1), enhanced action of insulin and reduced release of glucagon. Rise in new beta-cells and inhibition of their apoptosis is seen with DPP4i which can potentially improve the disease pathogenesis [4]. The American Diabetes Association (ADA) guidelines recommend DPP4i as second-line therapy after metformin [5]. Therefore, DPP4i can be the choice of drugs in every T2D patient.

Teneligliptin, characterized by a considerably rigid structure formed by five consecutive rings, is a novel dipeptidyl peptidase-4 (DPP-4) inhibitor for the treatment of type 2 diabetes. Introduction of the 1-(1-phenylpyrazol-5-yl) piperazine moiety (anchor lock domain), which binds to the S2 extensive subsite, increased the activity by 1500-fold over the corresponding fragment that binds to S1 and S2 only. As the metabolites of this drug are excreted through the hepatic (35%) and renal (65%) routes, no dose adjustment is necessary in patients with renal impairment. Particularly because of its long half-life, this drug

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has been shown to stabilize glucose fluctuations throughout the day [6].

## MATERIALS AND METHODS

The present study was undertaken in the Department of Pharmacology, Sri Guru Ram Das Institute of Medical Sciences and Research, Vallah, Amritsar.

### Subjects

A total of sixty patients were included in the study and were divided into two groups of thirty patients each.

### Drugs

Teneligliptin 10 mg once a day and metformin 500 mg twice a day were given after meals with a glass of water for 12 weeks duration and Glimepiride 1 mg once a day and Metformin 500 mg twice a day after meals for 12 weeks.

### Inclusion criteria

Diagnosed Type 2 Diabetes mellitus patients of either sex, aged 30-55 years, having fasting plasma glucose>126 mg/dL uncontrolled with monotherapy with metformin and HbA1c levels > 7% will be included in the present study.

### Exclusion criteria

- Patients with Type 1 diabetes mellitus.
- Patients with history of diabetic ketoacidosis in the past as it is delay in recovery of beta cells and require insulin for treatment.
- Patient allergic to any given medication i.e. Glimepiride.
- Patient with history of surgery in the past six weeks.
- Patient with history of bleeding disorders.
- Pregnant and lactating females.
- Patient with history of drug abuse and steroid treatment.
- Patient taking any other treatment which can alter glycaemic control and lipid profile.
- Patient with renal and hepatic disorder.
- Burn patients and patients with very high blood acid levels (acidosis).

This twelve week standard controlled and parallel randomized study involved 60 patients, of either sex, with Type 2 DM, fulfilling the inclusion criteria and attending the Medicine OPD at Sri Guru Ram Das Charitable Hospital attached to Sri Guru Ram Das Institute of Medical Sciences and Research, Vallah, Amritsar. The patients were randomly distributed into two groups, Group 1 and Group 2 consisting of thirty patients each.

Written Informed Consent was taken from the patients to be included in the present study and all the risks and the benefits were explained to each patient in their own language. Patients were advised to undertake diet control and regular exercise as per the protocol designed by W.H.O.

### Groups

**Group 1:** Group 1 patients were given combination of Teneligliptin 10 mg once a day and metformin 500 mg twice a day after meals for 12 weeks. Dose modifications were done according to the blood glucose levels. Dose of Metformin was increased to a maximum of 1000 mg twice a day.

**Group 2:** Group 2 patients were given combination of Glimepiride 1 mg once a day and metformin 500 mg twice a day after meals for 12 weeks. Dose modifications were done according to the blood glucose levels. Dose of Metformin was increased to a maximum of 1000 mg twice a day.

### Parameters of study

At the start of the study (day 0), history was taken from each patient. Clinical examination with routine investigations was done. The base line Fasting Blood Glucose (FBG), postprandial blood glucose (PPBG), HbA1c and lipid profile were obtained after a twelve hour overnight fast.

The patients were investigated for FBG and PPBG every week up to twelve weeks and HbA1c and lipid profile were done at the beginning of the study and at the end of the study

FBG, PPBG, HbA1c and lipid profile estimations were done in the biochemistry department, Sri Guru Ram Das Institute of Medical Sciences and Research. The patients were advised to report immediately in case they developed any adverse reaction e.g. nausea, vomiting, abdominal pain, muscle ache, fever, weight gain, diarrhoea, flatulence or any other type of side effect.

### Statistical analysis

The results obtained were analyzed statistically for the significance using Student's 't' test (paired and unpaired).

## RESULTS

There was no significant difference in mean age distribution in both the groups (Table 1, Figure 1).

**Table 1:** Mean age distribution in study groups (Mean ± SD).

| | Group 1 (n=30) | Group 2 (n=30) | 't' value | p value |
|---|---|---|---|---|
| Age (years) | 51.03 ± 5.07 | 51.03 ± 5.75 | 0 | 1.000$^{NS}$ |

n=no. of patients; 30 in each group; NS=Not significant (p>0.05); S=Significant (p<0.05,p<0.01); HS=Highly significant (p<0.001).

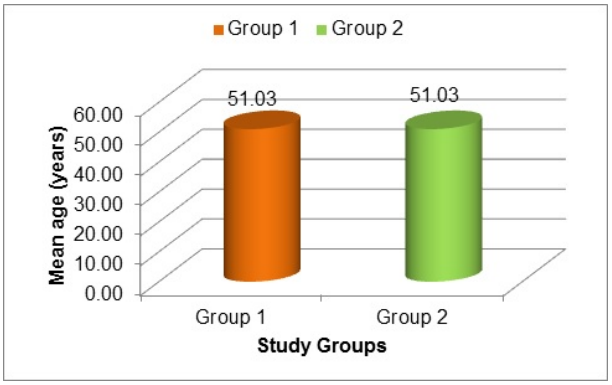


**Figure 1:** Mean age distribution in study group.

There were 6 males and 24 females in group 1 and 17 males and 13 females in group 2 (Table 2, Figure 2).

**Table 2:** Gender distribution in study groups.

| Sex | Group 1 | Group 2 |
|---|---|---|
| | N (%) | N (%) |
| Males | 6 (20%) | 17 (56.7%) |
| Females | 24 (80%) | 13 (43.3%) |

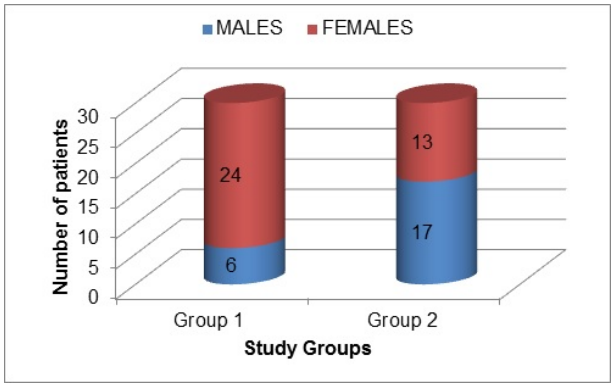


**Figure 2:** Gender distribution in study groups.

There was no significant difference in weight distribution in both the groups, significant difference in height distribution in both groups and highly significant difference in BMI with group 1 having higher BMI (Table 3, Figure 3).

**Table 3:** Anthropometry in study groups (Mean ± SD).

| | Group 1 (n=30) | Group 2 (n=30) | 't' value | p value |
|---|---|---|---|---|
| | Mean ± SD | Mean ± SD | | |
| Weight (kg) | 75.233 ± 8.42 | 77.133 ± 8.05 | 0.89 | $0.376^{NS}$ |
| Height (cm) | 155.967 ± 4.05 | 160.200 ± 5.35 | 3.45 | $0.001^{S}$ |
| BMI | 30.987 ± 3.88 | 25.172 ± 2.88 | 6.57 | $<0.001^{HS}$ |

n=no. of patients; NS=Not significant (p>0.05); S=Significant (p<0.05,p<0.01); HS=Highly significant (p<0.001).

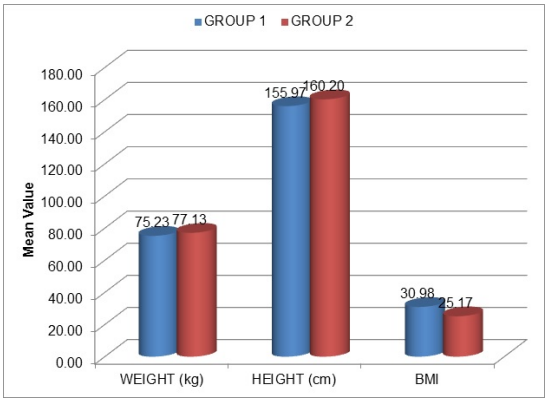


**Figure 3:** Anthropometry in study groups.

On comparison between group 1 and group 2, there was highly significant difference between the FBG levels in both the groups till third week of the study period (p<0.001).Thereafter there was a significant difference in the FBG levels between both the groups at 4th week of study period (p <0.05), then it was highly significant by the 10th week of study period (p<0.001) and significant in the 11th and 12th week of the study period (p<0.05) ( Table 4, Figure 4).

**Table 4:** Fasting blood glucose levels (Mean ± SD in mg/dL) over a period of 12 weeks in study groups.

| Duration (weeks) | Group 1 | Group 2 | 't' value | p value |
|---|---|---|---|---|
| Day 0 | 170.26 ± 31.60 | 140.13 ± 19.14 | 4.466 | $0.000^{HS}$ |
| 1st week | 161.81 ± 32.48 | 130.20 ± 18.38 | 4.638 | $0.000^{HS}$ |
| 2nd week | 157.36 ± 35.01 | 128.50 ± 24.67 | 3.691 | $0.000^{HS}$ |
| 3rd week | 150.87 ± 28.31 | 125.33 ± 18.63 | 4.126 | $0.000^{HS}$ |
| 4th week | 144.56 ± 29.07 | 123.43 ± 18.57 | 3.355 | $0.001^{S}$ |
| 5th week | 146.16 ± 27.56 | 120.76 ± 17.31 | 4.274 | $0.000^{HS}$ |
| 6th week | 152.63 ± 30.19 | 118.30 ± 16.49 | 5.466 | $0.000^{HS}$ |
| 7th week | 152.50 ± 33.21 | 116.83 ± 14.94 | 5.364 | $0.000^{HS}$ |
| 8th week | 147.16 ± 35.10 | 117.50 ± 11.12 | 4.413 | $0.000^{HS}$ |
| 9th week | 141.00 ± 33.87 | 114.83 ± 12.62 | 3.965 | $0.000^{HS}$ |
| 10th week | 133.67 ± 31.26 | 113.30 ± 9.94 | 3.4 | $0.000^{HS}$ |
| 11th week | 128.33 ± 31.26 | 109.50 ± 11.77 | 3.252 | $0.002^{S}$ |
| 12th week | 122.67 ± 29.56 | 105.33 ± 14.50 | 2.884 | $0.006^{S}$ |

n=no. of patients; 30 in each group; NS=Not significant (p>0.05); S=Significant (p<0.05, p<0.01); HS=Highly significant (p<0.001).

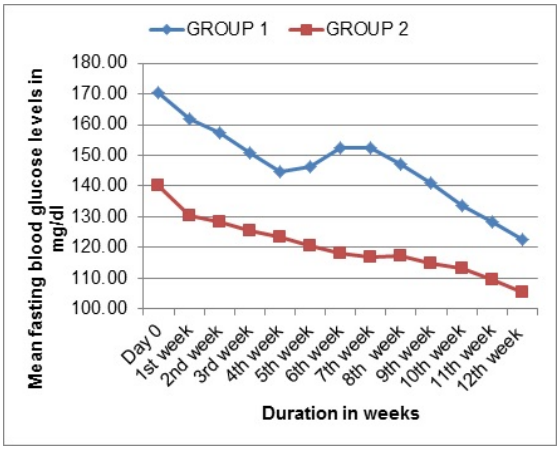


**Figure 4:** Fasting blood glucose levels over a period of 12 weeks in study groups.

Decrease in FBG was not significant in group 1 than group 2 up to 5 weeks ( p>0.05), then there was not significant decrease in group 2 than group1 in 6th and 7th week( p>0.05), then there was not significant decrease in group 1 than group 2 in 8th, 9th and 10th week(p>0.05) and then there was highly significant decrease in group 1 than group 2 in 11th and 12th week of study period (p<0.001) (Table 5, Figure 5).

**Table 5:** Change in fasting blood glucose levels (Mean ± SD in mg/dL) over a period of 12 weeks in study groups.

| Duration (weeks) | Group 1 | Group 2 | 't' value | p value |
|---|---|---|---|---|
| 0-1 | 8.45 ± 12.56 | 9.93 ± 11.30 | 0.48 | $0.633^{NS}$ |
| 0-2 | 12.90 ± 25.77 | 11.63 ± 15.16 | 0.232 | $0.817^{NS}$ |
| 0-3 | 19.40 ± 20.62 | 14.80 ± 15.29 | 0.981 | $0.330^{NS}$ |
| 0-4 | 25.70 ± 20.68 | 16.70 ± 15.21 | 1.92 | $0.060^{NS}$ |
| 0-5 | 24.10 ± 19.97 | 19.37 ± 16.71 | 0.996 | $0.324^{NS}$ |
| 0-6 | 17.63 ± 14.67 | 21.83 ± 16.70 | 1.035 | $0.305^{NS}$ |
| 0-7 | 17.77 ± 13.48 | 23.30 ± 16.26 | 1.435 | $0.157^{NS}$ |
| 0-8 | 23.10 ± 16.14 | 22.63 ± 16.19 | 0.112 | $0.911^{NS}$ |
| 0-9 | 29.27 ± 13.67 | 25.30 ± 16.82 | 1.003 | $0.320^{NS}$ |
| 0-10 | 36.60 ± 13.46 | 26.83 ± 14.08 | 2.746 | $0.008^{S}$ |
| 0-11 | 41.93 ± 11.79 | 30.63 ± 11.13 | 3.818 | $0.000^{HS}$ |
| 0-12 | 47.60 ± 7.73 | 34.80 ± 7.04 | 6.708 | $0.000^{HS}$ |

NS=Not significant (p>0.05); S=Significant (p<0.05, p<0.01) HS=Highly significant (p<0.001).

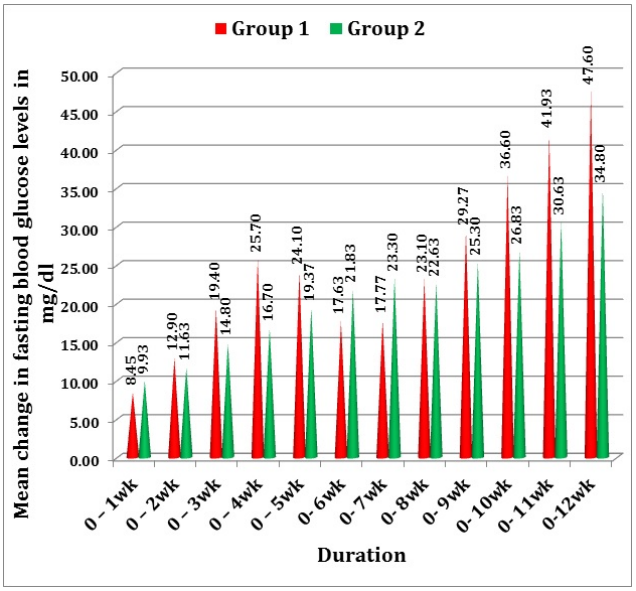


**Figure 5:** Change in fasting blood glucose levels (in mg/dL) over a period of 12 weeks in study groups.

On comparison between group 1 and group 2 significant difference is seen during the first week of study period (p<0.05). Thereafter, it was not significant up to 4th week of study period (p>0.05), then again significant up to 9th week (p<0.05) and then again not significant up to 12th week of study period (p>0.05) (Table 6, Figure 6).

**Table 6:** Post prandial blood glucose levels (Mean ± SD in mg/dL) over a period of 12 weeks in study groups.

| Duration (weeks) | Group 1 | Group 2 | 't' value | p value |
|---|---|---|---|---|
| Day 0 | 263.73 ± 43.05 | 243.86 ± 32.24 | 2.023 | $0.048^{S}$ |
| 1st week | 243.27 ± 45.92 | 227.60 ± 39.95 | 1.41 | $0.164^{NS}$ |
| 2nd week | 238.00 ± 47.63 | 224.10 ± 40.80 | 1.214 | $0.230^{NS}$ |
| 3rd week | 229.13 ± 45.76 | 220.80 ± 38.82 | 0.761 | $0.450^{NS}$ |
| 4th week | 226.63 ± 44.99 | 213.40 ± 36.70 | 1.248 | $0.217^{NS}$ |
| 5th week | 229.73 ± 41.35 | 205.87 ± 33.28 | 2.463 | $0.017^{S}$ |
| 6th week | 229.67 ± 40.19 | 204.00 ± 29.60 | 2.816 | $0.007^{S}$ |
| 7th week | 226.33 ± 41.25 | 200.73 ± 26.85 | 2.849 | $0.006^{S}$ |
| 8th week | 223.17 ± 40.69 | 197.00 ± 28.30 | 2.891 | $0.005^{S}$ |
| 9th week | 215.83 ± 41.14 | 196.00 ± 29.90 | 2.136 | $0.037^{S}$ |
| 10th week | 207.50 ± 40.14 | 190.33 ± 32.40 | 1.823 | $0.074^{NS}$ |

| | | | | |
|---|---|---|---|---|
| 11th week | 198.17 ± 40.86 | 188.17 ± 26.76 | 1.121 | 0.267NS |
| 12th week | 188.33 ± 38.11 | 186.17 ± 30.92 | 0.242 | 0.810NS |

S=Significant (p<0.05, p<0.01); HS=Highly significant (p<0.001).

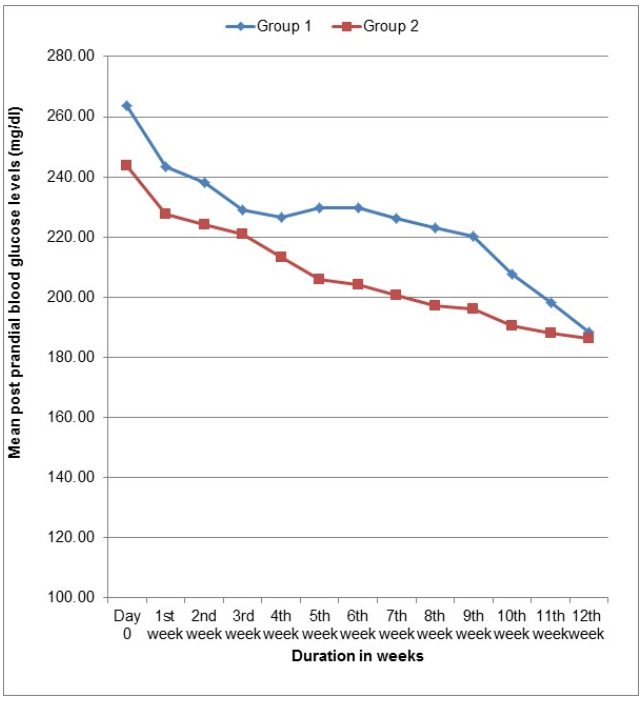


**Figure 6:** Post prandial blood glucose levels over a period of 12 weeks in study groups.

There was a not significant decrease in PPBG levels in group 1 than group 2 upto 4 weeks (p>0.05), then not significant decrease in group 2 than group 1 from 5th to 8th week (p>0.05), then not significant decrease in group 1 than group 2 in 9th and 10th week (p>0.05) and lastly highly significant decrease in group 1 than group 2 in 11th and 12th week of study period (p<0.001) (Table 7, Figure 7).

**Table 7:** change in post prandial blood glucose levels (Mean ± SD in mg/dL) over a period of 12 weeks in study groups.

| Duration ( weeks) | Group 1 | Group 2 | 't' value | p value |
|---|---|---|---|---|
| 0-1 | 20.47 ± 14.66 | 16.27 ± 22.19 | 0.865 | 0.391NS |
| 0-2 | 25.73 ± 16.28 | 19.77 ± 20.40 | 1.252 | 0.215NS |
| 0-3 | 34.60 ± 18.63 | 23.07 ± 17.53 | 2.47 | 0.016S |
| 0-4 | 37.10 ± 22.17 | 30.47 ± 17.24 | 1.294 | 0.201NS |
| 0-5 | 34.00 ± 22.42 | 38.00 ± 19.48 | 0.738 | 0.464NS |
| 0-6 | 34.07 ± 21.74 | 39.87 ± 20.65 | 1.059 | 0.294NS |
| 0-7 | 37.40 ± 22.80 | 43.13 ± 20.76 | 1.018 | 0.313NS |
| 0-8 | 40.57 ± 19.26 | 46.87 ± 22.72 | 1.159 | 0.251NS |
| 0-9 | 47.90 ± 19.53 | 47.87 ± 22.10 | 0.006 | 0.995NS |
| 0-10 | 56.23 ± 14.19 | 53.53 ± 20.72 | 0.589 | 0.558NS |
| 0-11 | 65.57 ± 11.40 | 55.70 ± 13.11 | 3.111 | 0.003S |
| 0-12 | 75.40 ± 10.47 | 57.70 ± 6.99 | 7.701 | 0.000HS |

NS=Not significant (p>0.05); S=Significant (p<0.05,p<0.01); HS=Highly significant (p<0.001).

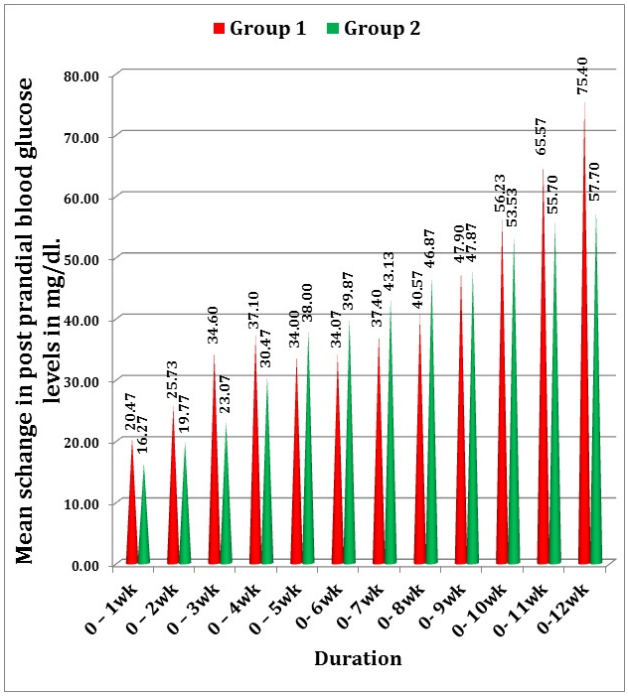


**Figure 7:** Change in post prandial blood glucose levels (in mg/dL) over a period of 12 weeks in study groups.

On comparison between group 1 and group 2, significant difference is seen in the level of HbA1c at the baseline (p<0.05) as well as at the end of study duration (p<0.05) (Table 8, Figure 8).

**Table 8**: Serum HbA1c levels (Mean± SD) (in mg/dL) over a period of 12 weeks in study groups.

| Duration (weeks) | Group 1 | Group 2 | 't' value | p value |
|---|---|---|---|---|
| Day 0 | 11.78 ± 1.61 | 10.27 ± 1.61 | 3.635 | 0.001S |
| 12th week | 10.49 ± 1.52 | 9.31 ± 1.58 | 2.961 | 0.004S |

S=Significant (p<0.05, p<0.01).

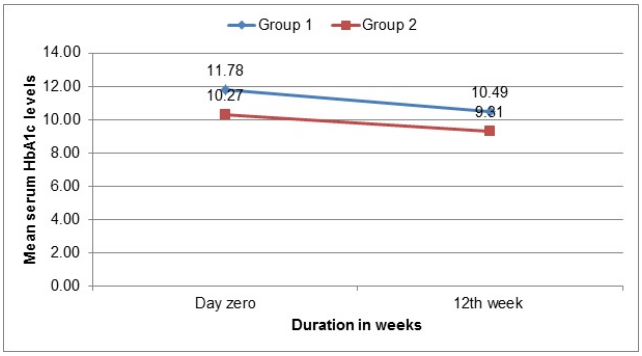


**Figure 8:** Serum HbA1c levels over a period Of 12 weeks in study groups.

There was highly significant decrease in mean HbA1c in group 1 than group 2 at the end of study period (p< 0.001) (Table 9, Figure 9).

**Table 9:** Change in serum HbA1c levels (Mean± SD) in mg/dL over a period of 12 weeks in study groups.

| Duration (weeks) | Group 1 | Group 2 | 't' value | p value |
|---|---|---|---|---|
| 0-12 | 1.29 ± 0.15 | 0.96 ± 0.181 | 7.746 | 0.000$^{HS}$ |

HS=Highly significant (p<0.001).

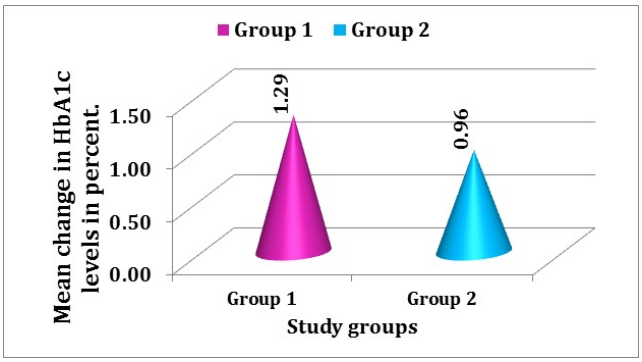


**Figure 9:** Change in serum HbA1c levels (in percent) over a period of 12 weeks in study groups.

On comparison between group 1 and group 2, significant difference is not seen in the cholesterol levels at the baseline (p>0.05) as well as at the end of study (p>0.05) (Table 10, Figure 10).

**Table 10:** Serum total cholesterol levels (Mean ± SD in mg/dL) over a period of 12 weeks in study groups.

| Duration (weeks) | Group 1 | Group 2 | 't' value | p value |
|---|---|---|---|---|
| Day 0 | 171.90 ± 43.75 | 178.54 ± 64.43 | 0.467 | 0.642$^{NS}$ |
| 12$^{th}$ week | 151.07 ± 41.50 | 162.67 ± 64.43 | 0.832 | 0.409$^{NS}$ |

NS=Not significant (p>0.05).

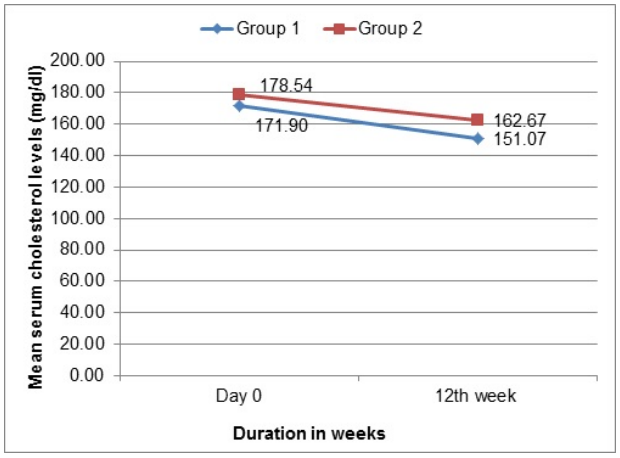


**Figure 10:** Serum total cholesterol levels over a period of 12 weeks in study groups.

There was a highly significant decrease in serum cholesterol levels in group 1 than group 2 at the end of the study (p<0.001) (Table 11, Figure 11).

**Table 11:** Change in serum total cholesterol levels (Mean± SD in mg/dL) over a period of 12 weeks in study groups.

| Duration (weeks) | Group 1 | Group 2 | 't' value | p value |
|---|---|---|---|---|
| 0-12 | 20.83 ± 4.66 | 15.87 ± 4.42 | 4.229 | 0.000$^{HS}$ |

HS=Highly significant (p<0.001).

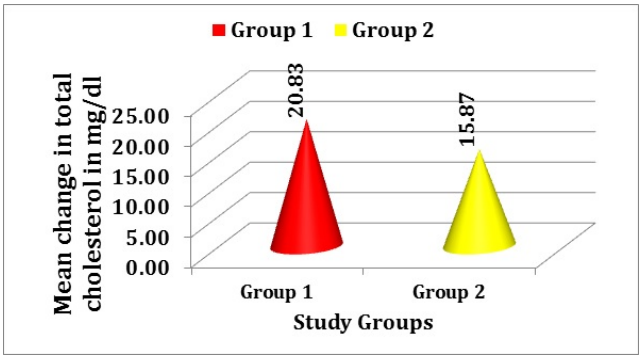


**Figure 11:** Change in serum total cholesterol levels in mg/dL over a period of 12 weeks in study groups.

On comparison between group 1 and group 2, not significant difference is seen in triglyceride level at the baseline (p>0.05) as well as at the end of study period (p>0.05) (Table 12, Figure 12).

**Table 12:** Serum triglyceride levels (Mean ± SD) over a period of 12 weeks in study groups.

| Duration (weeks) | Group 1 | Group 2 | 't' value | p value |
|---|---|---|---|---|
| Day 0 | 228.16 ± 74.47 | 252.31 ± 83.72 | 1.18 | 0.243$^{NS}$ |

| | | | | |
|---|---|---|---|---|
| 12th week | 205.47 ± 72.90 | 235.17 ± 83.63 | 1.466 | 0.148NS |

NS=Not significant (p>0.05).

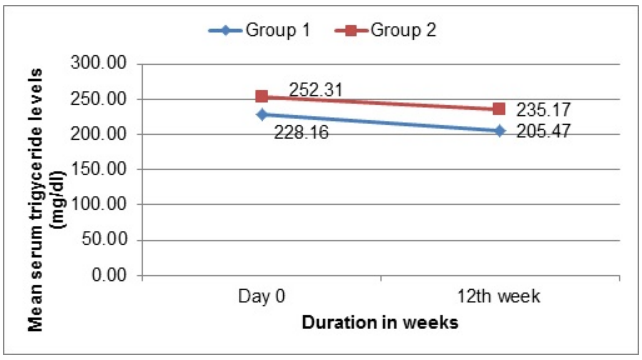


**Figure 12:** Serum triglycerides levels over a period of 12 weeks in study groups.

There was a highly significant decrease in serum triglyceride levels in group 1 than group 2 at the end of the study period (p<0.001) (Table 13, Figure 13).

**Table 13:** Change in serum triglyceride levels (Mean ± SD in mg/dL) over a period of 12 weeks in study groups.

| Duration (weeks) | Group 1 | Group 2 | 't' value | p value |
|---|---|---|---|---|
| 0-12 | 22.70 ± 3.65 | 17.15 ± 4.70 | 5.114 | 0.000HS |

HS= Highly significant (p<0.001).

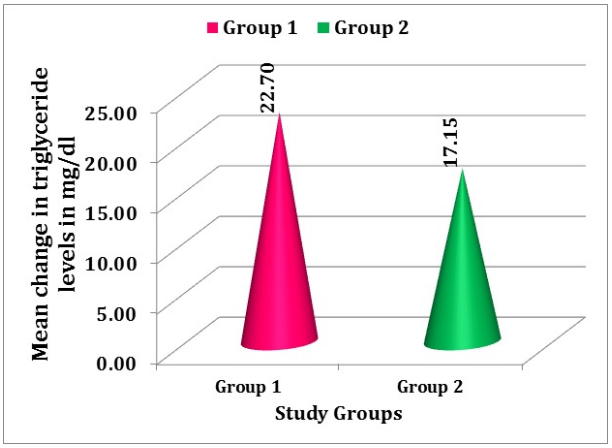


**Figure 13:** Change in serum triglyceride levels (Mean ± SD in mg/dL) over a period of 12 weeks in study groups.

On comparison between group 1 and group 2, not significant difference is seen in the HDL levels at the baseline (p>0.05) as well as at the end of study period ( p>0.05) (Table 14, Figure 14).

**Table 14:** Serum HDL levels (Mean ± SD) over a period of 12 weeks in study groups.

| Duration (weeks) | Group 1 | Group 2 | 't' value | p value |
|---|---|---|---|---|
| Day 0 | 44.93 ± 9.38 | 43.30 ± 12.47 | 0.571 | 0.570NS |
| 12th week | 58.87 ± 11.51 | 54.63 ± 12.88 | 1.342 | 0.185NS |

NS=Not significant (p>0.05).

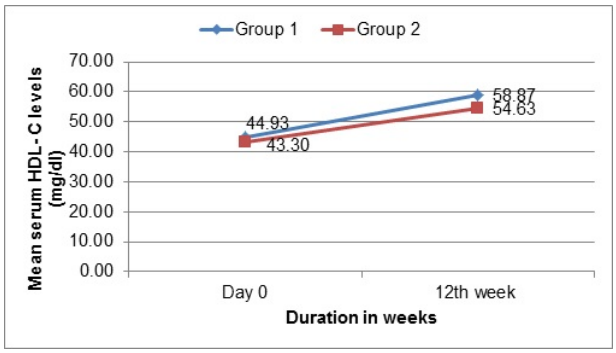


**Figure 14:** Serum HDL-C levels over a period of 12 weeks in study groups.

There was not significant increase in serum HDL levels in group 1 than group at the end of study period (p>0.05) (Table 15, Figure 15).

**Table 15:** Change in serum HDL Levels (Mean± SD in mg/dL) over a period of 12 weeks in study groups.

| Duration (weeks) | Group 1 | Group 2 | 't' value | p value |
|---|---|---|---|---|
| 0-12 | 13.93 ± 8.71 | 11.33 ± 2.45 | 1.578 | 0.120NS |

NS=Not significant (p>0.05).

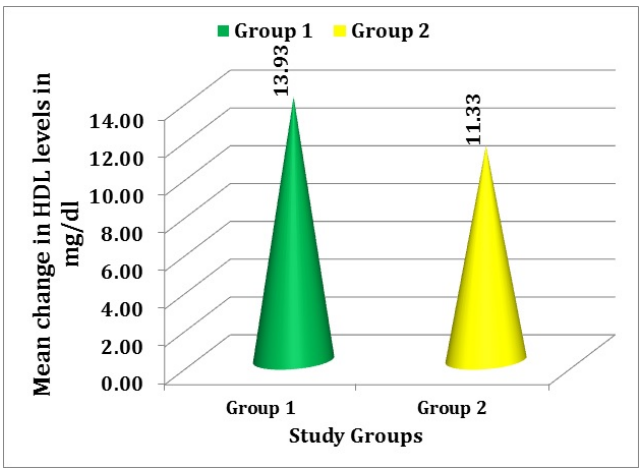


**Figure 15:** Change in serum HDL Levels in mg/dL over a period of 12 weeks in study groups.

On comparison between group 1 and group 2, not significant difference is seen in the levels of LDL at the baseline (p>0.05) as well as at the end of study period (p>0.05) (Table 16, Figure 16).

**Table 16:** Serum LDL levels (Mean ± SD in mg/dL) over a period of 12 weeks in study groups.

| Duration (weeks) | Group 1 | Group 2 | 't' value | p value |
|---|---|---|---|---|
| Day 0 | 102.73 ± 21.62 | 94.73 ± 12.01 | 1.772 | 0.082$^{NS}$ |
| 12$^{th}$ week | 87.20 ± 18.34 | 84.00 ± 10.62 | 0.827 | 0.412$^{NS}$ |

n=no. of patients; NS=Not significant (p>0.05).

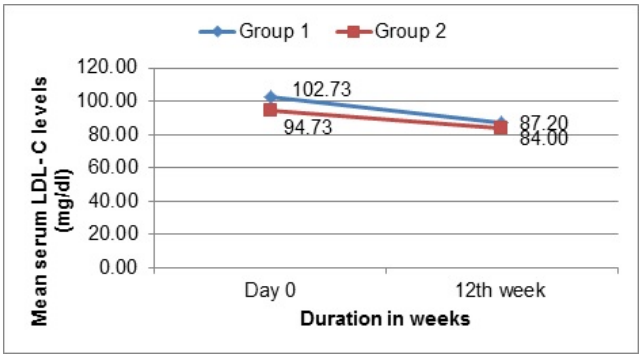


**Figure 16:** Serum LDL-C levels over a period of 12 weeks in study groups.

There was a highly significant decrease in serum LDL levels in group 1 than group 2 at the end of the study period (p<0.001) (Table 17, Figure 17).

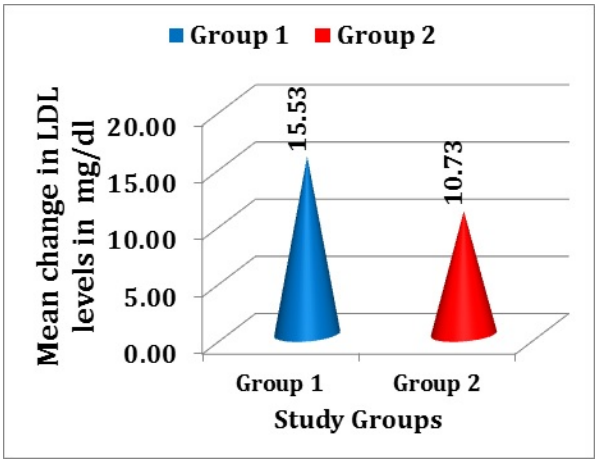


**Figure 17:** Change in serum LDL levels (Mean) in mg/dL over a period of 12 weeks in study groups.

| Duration (weeks) | Group 1 | Group 2 | 't' value | p value |
|---|---|---|---|---|
| 0- 12 | 15.53 ± 4.80 | 10.73 ± 3.30 | 4.519 | 0.000$^{HS}$ |

HS=Highly significant (p<0.001).

**Table 17:** Serum LDL levels (Mean ± SD in mg/dL) over a period of 12 weeks in study groups.

In group 1, one case each of nausea, fatigue, numbness and gastritis was reported. All these adverse effects were mild in nature and none of the patients needed withdrawal (Tables 18 and 19).

**Table 18:** Incidence of side effects in Group 1.

| Side effect | No. of patients |
|---|---|
| Pallor | 0 |
| Pain in abdomen | 0 |
| Anorexia | 0 |
| Nausea | 1 |
| Fatigue | 1 |
| Numbness | 1 |
| Metallic taste | 0 |
| Nasopharyngitis | 0 |
| Edema | 0 |
| Back pain | 0 |
| Gastritis | 1 |
| Any other | 0 |

**Table 19:** Incidence of side effects in Group 2.

| Side effect | No. of patients |
|---|---|
| Pallor | 1 |
| Pain in abdomen | 0 |
| Fatigue | 2 |
| Metallic taste | 0 |
| Nausea | 2 |
| Numbness | 1 |
| Chest pain | 0 |
| Hypoglycaemia | 1 |
| Blurred vision | 0 |
| Yellowing of eyes | 0 |
| Weight gain | 2 |
| Any other | 0 |

In group 2, two cases each of nausea, fatigue and weight gain were reported and one case each of pallor, numbness and

hypoglycaemia was reported. All these adverse effects were mild in nature and none of the patients needed withdrawal.

## DISCUSSION

The present study was conducted in this institute for a period from April 2017 to August 2018. In this study we compared the anti-hyperglycemic effect of teneligliptin and metformin versus glimepiride and metformin in the treatment of Type 2 DM patients uncontrolled with monotherapy. Sixty patients of Type 2 DM were included in the study and were divided in two groups of 30 each.

Group 1 patients were given only teneligliptin 10 mg once a day and metformin 500 mg twice a day after meals.

Group 2 patients were given glimepiride 1 mg once a day and metformin 500 mg twice a day after meal.

However the dosage of metformin was increased to 1000 mg twice a day if required.

The patients in each group received the treatment for 12 weeks duration.

The present study consisted of 23 males and 37 females. Majority of the patients were in the age group of 40-55 years. On comparison it was revealed that there was statistically no significant difference in age distribution in the two groups as on Day 0. There is no significant difference in weight distribution in both the groups, significant difference in height distribution in both groups and highly significant difference in BMI with group 1 having higher BMI.

In the present study it was observed that there was a highly significant decline in the mean FBG in group 1 patients. Similarly there was a highly significant reduction ($p<0.001$) in FBG in group 2 patients. However, the reduction in group 1 was greater than in group 2.

There was a highly significant ($p<0.001$) reduction in PPBG in both the groups. Change in PPBG was also greater in group 1 than in group 2. There was highly significant difference in change at the end of 12 weeks between both the groups.

In present study there was a highly significant reduction in HbA1c levels in both the groups. However, the mean decrease in HbA1c was greater in group 1 as compared to group 2.

In the present study there was a significant reduction in Total Serum Cholesterol levels in both the groups ($p<0.01$). However, reduction in group 1 was greater than in group 2. Similarly there was a greater reduction in serum Triglycerides and serum LDL levels in group 1 as compared to group 2 at the end of $12^{th}$ week of study. However this reduction was highly significant in both the groups. Whereas no significant increase in serum HDL levels in both group 1 and group 2 was observed, with increase in group 1 being greater.

A study was carried out by Zhu et al. in May 2013 about the comparative efficacy of glimepiride and metformin of type 2 diabetes mellitus which was a meta analysis of randomized controlled trials. The results of the study were that metformin was not better than glimepiride in overall efficacy in controlling the levels of HbA1c, postprandial blood sugar, fasting plasma insulin, systolic and diastolic blood pressures and high density lipoproteins. Metformin was only effective than glimepiride in controlling the level of total cholesterol, low density lipoproteins and triglycerides [7].

Kim et al. reported similar findings of significant reduction of HbA1c and FBS in as early as 4 weeks when teneligliptin was added to metformin [8].

In Gadge et al. study, they observed no significant reduction in FBS ($p=0.353$) with teneligliptin and metformin. Non-significant reduction in FBS in Gadge et al. study was because of lower mean FBS (107.3 ± 18.9 mg/dL) at the baseline [9].

Kim et al. study had mean FBS level of 150.3 ± 27.6 mg/dL whereas HbA1c values were comparable [8]. Interestingly, there was similar fidings of significant reduction in PPBS (-14.3 mg/dL, $p=0.009$) in Gadge et al. study. Not many studies have reported PPBS reduction with teneligliptin [9].

## CONCLUSION

Metformin-teneligliptin combination therapy for T2DM is better for its effectiveness, significantly improved the glycemic and lipid profile of the Type 2 DM patients with better safety and tolerability as compared to glimepiride and metformin group.

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