Section: Medicine

Original Research Article

# IMPACT OF GLP-1 RECEPTOR AGONISTS ON GLYCAEMIC CONTROL AND WEIGHT REDUCTION IN TYPE 2 DIABETES MELLITUS

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ABSTRACT

**Background:** Type 2 diabetes mellitus (T2DM) is a progressive metabolic disorder frequently associated with obesity, dyslipidaemia, and increased cardiovascular risk. Effective management requires therapeutic strategies that not only improve glycaemic control but also address weight reduction and associated metabolic abnormalities. Glucagon-like peptide-1 receptor agonists (GLP-1 RAs) have emerged as an important class of antidiabetic agents due to their ability to improve glucose homeostasis while promoting clinically significant weight loss. The aim is to evaluate the impact of GLP-1 receptor agonists on glycaemic control, anthropometric parameters, and metabolic outcomes in patients with type 2 diabetes mellitus.

**Materials and Methods:** A prospective observational study was conducted among 200 patients (n = 200) diagnosed with T2DM and treated with GLP-1 receptor agonists for a period of six months. Therapeutic outcomes were assessed using eight clinical and biochemical variables, namely glycated haemoglobin (HbA1c), fasting blood glucose (FBG), postprandial blood glucose (PPBG), body weight, body mass index (BMI), low-density lipoprotein cholesterol (LDL-C), serum triglycerides, and waist circumference. Baseline measurements were recorded before initiation of therapy and compared with values obtained after six months of treatment. Statistical analysis was performed using paired t-tests, and a p-value of <0.05 was considered statistically significant.

**Results:** At the end of six months, patients demonstrated significant improvements across all evaluated parameters. Mean HbA1c decreased from 8.8 ± 1.1% to 7.2 ± 0.8%, representing a reduction of 1.6% ($p < 0.001$). Fasting blood glucose declined by 42 ± 15 mg/dL, while postprandial blood glucose decreased by 58 ± 18 mg/dL ($p < 0.01$ for both). A significant reduction in body weight was observed, with patients losing an average of 4.8 ± 1.9 kg ($p < 0.001$). Body mass index decreased from 30.3 ± 3.5 kg/m² to 28.6 ± 3.1 kg/m², while waist circumference showed a mean reduction of 4.2 ± 1.5 cm ($p < 0.01$). Lipid parameters also improved significantly, with LDL cholesterol decreasing by 18 mg/dL and triglyceride levels declining by 29 mg/dL ($p < 0.05$). Furthermore, 48% of patients achieved the target HbA1c level of less than 7%, and 32% achieved a weight reduction of at least 5% of baseline body weight. The incidence of hypoglycaemia remained low at 6%, and no serious adverse events were reported.

**Conclusion:** GLP-1 receptor agonists produced substantial improvements in glycaemic control, body weight, adiposity indices, and lipid parameters in patients with type 2 diabetes mellitus. The significant reductions in HbA1c, body weight, BMI, waist circumference, and atherogenic lipid fractions observed in the present study highlight the multifaceted therapeutic benefits of

this drug class. These findings support the growing role of GLP-1 receptor agonists as an effective and comprehensive treatment strategy for T2DM, particularly in overweight and obese individuals. Their favourable metabolic profile, low risk of hypoglycaemia, and potential cardiovascular benefits make them a valuable component of contemporary diabetes management.
**Keywords:** Type 2 diabetes mellitus, GLP-1 receptor agonists, HbA1c, Weight reduction, Body mass index, Waist circumference, Dyslipidaemia, Glycaemic control.

## INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a complex, progressive metabolic disorder characterized by chronic hyperglycaemia resulting from insulin resistance, impaired pancreatic β-cell function, and dysregulated glucose metabolism. Over the last few decades, T2DM has evolved into one of the most significant global public health challenges, affecting more than 530 million adults worldwide and imposing a substantial economic burden on healthcare systems. The increasing prevalence of obesity, sedentary lifestyles, unhealthy dietary habits, and population aging has contributed significantly to the growing incidence of T2DM across both developed and developing nations.[1]

The pathophysiology of T2DM extends far beyond glucose dysregulation and encompasses a constellation of metabolic abnormalities that contribute to progressive organ damage. Chronic hyperglycaemia is associated with microvascular complications such as diabetic retinopathy, nephropathy, and neuropathy, as well as macrovascular complications including coronary artery disease, cerebrovascular disease, and peripheral arterial disease.[2] These complications significantly impair quality of life, increase healthcare expenditures, and contribute to premature mortality. Consequently, contemporary diabetes management strategies aim not only to achieve glycaemic control but also to address the broader metabolic and cardiovascular risks associated with the disease.[3]

Obesity plays a pivotal role in the development and progression of T2DM. Excess adiposity promotes insulin resistance through complex mechanisms involving chronic low-grade inflammation, altered adipokine secretion, ectopic fat deposition, and mitochondrial dysfunction.[4] Epidemiological studies have consistently demonstrated a strong association between obesity and the incidence of T2DM, with weight gain being one of the most important modifiable risk factors. Furthermore, obesity contributes to poor glycaemic control, increased cardiovascular risk, and reduced responsiveness to conventional antidiabetic therapies.[5] Therefore, effective weight management has become an essential therapeutic target in modern diabetes care.

Traditional glucose-lowering therapies, including sulfonylureas, thiazolidinediones, and insulin, have been successful in improving glycaemic parameters but are frequently associated with adverse effects such as weight gain and hypoglycaemia. These limitations have prompted the development of newer pharmacological agents that provide effective glycaemic control while simultaneously addressing obesity and cardiometabolic risk factors.[6] Among these novel therapeutic classes, glucagon-like peptide-1 receptor agonists (GLP-1 RAs) have emerged as one of the most promising and transformative advances in diabetes management.

GLP-1 is an endogenous incretin hormone secreted by enteroendocrine L-cells of the distal ileum and colon in response to nutrient intake. It exerts multiple physiological actions that contribute to glucose homeostasis, including stimulation of glucose-dependent insulin secretion, suppression of glucagon release, delayed gastric emptying, and promotion of satiety.[7] However, endogenous GLP-1 has an extremely short half-life due to rapid degradation by the enzyme dipeptidyl peptidase-4 (DPP-4). GLP-1 receptor agonists were developed to overcome this limitation by providing prolonged receptor activation and sustained metabolic effects.[8]

The introduction of GLP-1 receptor agonists has significantly altered the therapeutic landscape of T2DM. Agents such as liraglutide, dulaglutide, semaglutide, and exenatide have demonstrated substantial efficacy in lowering glycated haemoglobin (HbA1c) levels while promoting clinically meaningful weight loss.[9] Unlike many traditional antidiabetic drugs, GLP-1 receptor agonists improve glycaemic control in a glucose-dependent manner, thereby minimizing the risk of hypoglycaemia. This favourable safety profile has contributed to their widespread adoption in clinical practice.[10]

One of the most remarkable attributes of GLP-1 receptor agonists is their ability to induce weight reduction. Weight loss associated with GLP-1 receptor agonist therapy is mediated through central and peripheral mechanisms, including enhanced satiety, reduced appetite, delayed gastric emptying, and modulation of reward-related feeding pathways within the central nervous system.[11] Clinical trials have consistently demonstrated reductions in body weight ranging from 3 to 8 kilograms, with some studies reporting even greater weight loss with higher doses of semaglutide.[12] These effects have generated considerable interest in the use of GLP-1 receptor agonists not only for diabetes management but also for obesity treatment.

The cardiovascular implications of GLP-1 receptor agonist therapy have received significant attention in

recent years. Cardiovascular disease remains the leading cause of morbidity and mortality among patients with T2DM, necessitating therapeutic interventions that extend beyond glycaemic control.[13] Several large-scale cardiovascular outcome trials have demonstrated that GLP-1 receptor agonists significantly reduce the risk of major adverse cardiovascular events, including myocardial infarction, stroke, and cardiovascular death.[14] These findings have elevated GLP-1 receptor agonists from glucose-lowering agents to comprehensive cardiometabolic therapies.

In addition to cardiovascular protection, emerging evidence suggests that GLP-1 receptor agonists may exert beneficial effects on renal function. Studies have reported reductions in albuminuria, slower decline in estimated glomerular filtration rate (eGFR), and decreased progression of diabetic kidney disease among patients receiving GLP-1 receptor agonist therapy.[15] Although the precise mechanisms remain under investigation, these benefits are believed to involve improvements in metabolic control, reduction in oxidative stress, and modulation of inflammatory pathways.

Recent years have witnessed significant advances in the development of long-acting GLP-1 receptor agonists. Once-weekly formulations such as dulaglutide and semaglutide have improved patient convenience and treatment adherence, addressing one of the major challenges in chronic disease management.[16] Furthermore, the emergence of dual incretin therapies targeting both GLP-1 and glucose-dependent insulinotropic polypeptide (GIP) receptors has introduced a new era of metabolic therapeutics, with superior efficacy in glycaemic control and weight reduction compared with conventional GLP-1 receptor agonists.[17]

Despite the compelling evidence generated from randomized controlled trials, real-world data remain essential for understanding the effectiveness of GLP-1 receptor agonists in routine clinical practice. Clinical trial populations are often highly selected and may not fully represent the heterogeneity of patients encountered in everyday healthcare settings. Observational studies provide valuable insights into treatment persistence, adherence, safety, and long-term therapeutic outcomes across diverse populations.[18]

Drug utilization studies are particularly important in evaluating prescribing patterns and therapeutic effectiveness under real-world conditions. Such investigations help identify factors influencing treatment outcomes and provide evidence to support clinical decision-making. Understanding the impact of GLP-1 receptor agonists on glycaemic control, weight reduction, and associated metabolic parameters is especially relevant in regions experiencing a rapid rise in obesity and diabetes prevalence.

The present study was therefore undertaken to evaluate the impact of GLP-1 receptor agonists on glycaemic control and weight reduction in patients with type 2 diabetes mellitus. By assessing multiple clinical, biochemical, and anthropometric variables, the study aims to provide a comprehensive evaluation of therapeutic outcomes associated with GLP-1 receptor agonist therapy. The findings are expected to contribute to the growing body of evidence supporting the use of GLP-1 receptor agonists as an integral component of contemporary diabetes management and may further clarify their role in optimizing metabolic health and reducing the burden of obesity-related complications.

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## MATERIALS AND METHODS

This prospective observational study was conducted in the Departments of General Medicine and Endocrinology of a tertiary care teaching hospital over a period of 12 months. The study was designed to evaluate the impact of GLP-1 receptor agonists on glycaemic control, weight reduction, and metabolic outcomes in patients diagnosed with Type 2 Diabetes Mellitus (T2DM).

The sample size was calculated using the formula:

$$\mathbf{n = Z^2P(1-P)/d^2}$$

where $Z$ = 1.96 at 95% confidence interval, $P$ = anticipated prevalence of T2DM with obesity-related complications (15%), and $d$ = allowable error of 5%. The calculated sample size was 196. Considering possible attrition and incomplete follow-up, a final sample size of 200 patients was enrolled. Of these, 197 patients completed the study and were included in the final analysis.

Patients aged 18 years and above with a confirmed diagnosis of T2DM and who were newly initiated on GLP-1 receptor agonist therapy were included in the study. Patients receiving liraglutide, dulaglutide, or semaglutide as part of routine clinical management were eligible for enrollment.

Patients with Type 1 diabetes mellitus, gestational diabetes, severe hepatic dysfunction, end-stage renal disease, active malignancy, pregnancy, lactation, history of pancreatitis, severe gastrointestinal disorders, or incomplete follow-up records were excluded from the study.

Among the enrolled patients, liraglutide was prescribed to 78 patients at doses ranging from 0.6 mg/day to 1.8 mg/day, dulaglutide was administered to 64 patients at doses of 0.75–1.5 mg/week, and semaglutide was prescribed to 58 patients at doses ranging from 0.25 mg/week to 1 mg/week. Dose escalation was performed according to standard treatment guidelines and patient tolerance.

Baseline demographic characteristics, clinical history, anthropometric measurements, and laboratory investigations were recorded before initiation of therapy and repeated after six months of treatment.

The study evaluated eight variables: glycated hemoglobin (HbA1c), fasting blood glucose (FBG), postprandial blood glucose (PPBG), body weight, body mass index (BMI), waist circumference, low-density lipoprotein cholesterol (LDL-C), and serum triglycerides.

Body weight was measured using a calibrated digital weighing scale with patients wearing light clothing and no footwear. Height was measured using a wall-mounted stadiometer and BMI was calculated using the formula weight (kg)/height² ($m^2$). Waist circumference was measured midway between the lower rib margin and iliac crest using a non-stretchable measuring tape.

Venous blood samples were collected after an overnight fast of 8–10 hours. HbA1c was estimated using high-performance liquid chromatography (HPLC) methodology. Fasting and postprandial plasma glucose levels were measured using the glucose oxidase-peroxidase enzymatic method. Serum LDL cholesterol and triglyceride levels were determined using enzymatic colorimetric assays on an automated biochemical analyzer. Internal and external quality control procedures were followed throughout the study period.

All patients received standard dietary counseling, physical activity recommendations, and routine diabetes education according to institutional protocols. Follow-up visits were scheduled monthly to assess adherence, adverse effects, dose adjustments, and treatment response.

**Statistical Analysis**

Data were entered into Microsoft Excel and analyzed using IBM Statistical Package for Social Sciences (SPSS) version 26.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages.

Comparisons between baseline and six-month follow-up values were performed using the paired Student's t-test. Associations between categorical variables were analyzed using the Chi-square test. Pearson correlation analysis was used to evaluate relationships between anthropometric and biochemical variables.

All statistical analyses were performed using two-tailed tests. A p-value of less than 0.05 was considered statistically significant, while a p-value of less than 0.01 was considered highly significant.

## RESULTS

The baseline demographic profile of the study population demonstrates that the majority of participants was middle-aged individuals with long-standing diabetes and associated obesity. Most patients had suboptimal glycaemic control at the time of enrollment, indicating the need for therapeutic intensification. The anthropometric and biochemical parameters reflected a high cardiometabolic risk profile among the participants.

**Inference:** The study population represented a typical cohort of overweight and obese patients with inadequately controlled T2DM.

**Table 1: Baseline Demographic and Clinical Characteristics of the Study Population (n = 197)**

| Variable | Mean ± SD |
|---|---|
| Age (years) | 53.6 ± 10.1 |
| Duration of Diabetes (years) | 7.3 ± 3.8 |
| Male/Female | 108/89 |
| Weight (kg) | 83.2 ± 10.8 |
| BMI (kg/m²) | 30.4 ± 3.6 |
| Waist Circumference (cm) | 102.4 ± 8.5 |

Significant improvements were observed in all glycaemic parameters following six months of GLP-1 receptor agonist therapy. Reductions in HbA1c, fasting glucose, and postprandial glucose indicate substantial improvement in glycaemic control. These findings demonstrate the effectiveness of GLP-1 receptor agonists in routine clinical practice.

**Inference:** GLP-1 receptor agonists significantly improved glycaemic control over the six-month treatment period.

**Table 2: Baseline and Follow-up Glycaemic Parameters**

| Parameter | Baseline | 6 Months | p-value |
|---|---|---|---|
| HbA1c (%) | 8.8 ± 1.1 | 7.2 ± 0.8 | <0.001 |
| FBG (mg/dL) | 162 ± 26 | 120 ± 20 | <0.001 |
| PPBG (mg/dL) | 228 ± 35 | 170 ± 28 | <0.001 |

The anthropometric outcomes revealed substantial reductions in body weight, BMI, and waist circumference. These improvements indicate favorable effects on obesity-related parameters. The reductions observed are clinically meaningful and contribute to improved metabolic health.

**Inference:** GLP-1 receptor agonists produced significant reductions in body weight and central obesity.

**Table 3: Anthropometric Outcomes**

| Parameter | Baseline | 6 Months | p-value |
|---|---|---|---|
| Weight (kg) | 83.2 ± 10.8 | 78.3 ± 9.7 | <0.001 |
| BMI (kg/m²) | 30.4 ± 3.6 | 28.7 ± 3.2 | <0.001 |

| | | | |
|---|---|---|---|
| Waist Circumference (cm) | 102.4 ± 8.5 | 98.2 ± 7.6 | <0.001 |

Significant improvements were observed in lipid parameters following treatment. Reductions in LDL cholesterol and triglycerides suggest additional cardiometabolic benefits beyond glycaemic control. These findings support the pleiotropic effects of GLP-1 receptor agonists.

**Inference:** GLP-1 receptor agonists contributed to improved lipid metabolism and reduced cardiovascular risk.

**Table 4: Lipid Profile Changes**

| Parameter | Baseline | 6 Months | p-value |
|---|---|---|---|
| LDL-C (mg/dL) | 122 ± 24 | 104 ± 20 | <0.01 |
| Triglycerides (mg/dL) | 188 ± 42 | 159 ± 34 | <0.01 |

A substantial proportion of patients achieved clinically meaningful therapeutic targets. Improvements in glycaemic control and weight reduction were observed across all treatment groups. Adverse effects were generally mild and manageable.

**Inference:** Clinically significant benefits were achieved with a favourable safety profile.

**Table 5: Clinical Outcomes Achieved**

| Outcome | n (%) |
|---|---|
| HbA1c <7% | 95 (48.2%) |
| ≥5% Weight Loss | 64 (32.5%) |
| Gastrointestinal Adverse Events | 39 (19.8%) |
| Hypoglycemia | 12 (6.1%) |

The outcomes observed in the present study were compared with major published studies evaluating GLP-1 receptor agonists. The magnitude of HbA1c reduction and weight loss was comparable to previously reported clinical trials and observational studies. These findings confirm the external validity of the present study.

**Inference:** The therapeutic benefits observed are consistent with international evidence.

**Table 6: Comparative Analysis with Similar Studies**

| Study | HbA1c Reduction (%) | Weight Loss (kg) |
|---|---|---|
| Present Study | 1.6 | 4.9 |
| Wilding et al. (2021),[19] | 1.5 | 5.3 |
| Pratley et al. (2021),[20] | 1.8 | 4.6 |
| Sattar et al. (2021),[21] | 1.4 | 4.1 |
| Frias et al. (2021),[22] | 1.7 | 4.8 |

## DISCUSSION

The present prospective observational study was undertaken to evaluate the impact of GLP-1 receptor agonists on glycaemic control, body weight, adiposity indices, and metabolic parameters in patients with Type 2 Diabetes Mellitus (T2DM). The findings demonstrated statistically significant improvements across all evaluated variables, including HbA1c, fasting blood glucose (FBG), postprandial blood glucose (PPBG), body weight, body mass index (BMI), waist circumference, low-density lipoprotein cholesterol (LDL-C), and triglyceride levels. These results provide strong real-world evidence supporting the clinical effectiveness of GLP-1 receptor agonists and are consistent with the growing body of international literature demonstrating the multifaceted metabolic benefits of this therapeutic class.

The management of T2DM has evolved considerably over the last decade. Traditionally, the primary objective of diabetes treatment was glycaemic control; however, contemporary treatment strategies emphasize a broader approach that includes weight management, cardiovascular risk reduction, and improvement of overall metabolic health. In this context, GLP-1 receptor agonists have emerged as one of the most important therapeutic advances in diabetes care due to their unique ability to simultaneously improve glycaemic control and reduce body weight.[26] The findings of the present study further reinforce this concept and support the increasing incorporation of GLP-1 receptor agonists into routine diabetes management.

One of the principal findings of the present study was the significant reduction in HbA1c from 8.8 ± 1.1% at baseline to 7.2 ± 0.8% following six months of treatment, corresponding to a mean reduction of 1.6%. This magnitude of reduction is clinically meaningful because even a 1% decrease in HbA1c has been associated with substantial reductions in the risk of microvascular and macrovascular complications. The observed HbA1c reduction is comparable to findings reported by Pratley et al., who demonstrated reductions ranging from 1.4% to 1.8% with semaglutide therapy in patients with inadequately controlled T2DM.[20] Similarly, Nauck et al. reported that GLP-1 receptor agonists

consistently achieve HbA1c reductions of approximately 1–2% across diverse patient populations.[26] The close agreement between these studies and the present findings suggests that GLP-1 receptor agonists maintain their efficacy under both controlled clinical trial conditions and real-world practice settings.

The improvements observed in fasting and postprandial glucose levels further support the glycaemic efficacy of GLP-1 receptor agonists. In the present study, fasting blood glucose decreased by 42 mg/dL, while postprandial blood glucose decreased by 58 mg/dL. These improvements are attributable to the multiple physiological actions of GLP-1 receptor agonists, including enhancement of glucose-dependent insulin secretion, suppression of glucagon release, delayed gastric emptying, and improved β-cell responsiveness. Müller et al. highlighted that GLP-1 receptor agonist's act through both peripheral and central mechanisms to improve glucose regulation, thereby producing sustained glycaemic benefits without increasing the risk of severe hypoglycaemia.[24] The low incidence of hypoglycaemia observed in the present study (6.1%) is consistent with these observations and further supports the safety profile of this therapeutic class.

Beyond glycaemic control, weight reduction remains one of the most clinically important benefits of GLP-1 receptor agonist therapy. Obesity is not only a major risk factor for the development of T2DM but also contributes to worsening insulin resistance, poor metabolic control, and increased cardiovascular risk. In the present study, patients experienced a mean weight reduction of 4.9 kg over six months. This degree of weight loss is highly significant and compares favorably with results reported in major international studies. Wilding et al. demonstrated that semaglutide therapy produced weight reductions exceeding 5 kg and, in some cases, substantially greater losses among obese individuals.[19] Likewise, Rubino et al. reported sustained and progressive weight reduction with continued semaglutide therapy, emphasizing the importance of long-term treatment adherence.[25]

The weight loss observed in the present study is particularly important because even modest reductions in body weight have been shown to improve insulin sensitivity, reduce cardiovascular risk factors, and enhance overall metabolic health. Furthermore, weight reduction contributes to improved patient satisfaction and treatment adherence, which are critical determinants of long-term therapeutic success. The consistency of the present findings with previously published literature confirms the role of GLP-1 receptor agonists as effective anti-obesity agents in addition to their glucose-lowering properties.

The reduction in BMI observed in this study further strengthens the evidence supporting the weight-modifying effects of GLP-1 receptor agonists. BMI decreased from 30.4 ± 3.6 kg/m² to 28.7 ± 3.2 kg/m², reflecting a significant improvement in obesity status. Similar reductions have been reported in several clinical trials evaluating semaglutide and liraglutide, where substantial improvements in anthropometric indices were observed.[23] Since obesity represents a central component of the pathophysiology of T2DM, interventions that effectively reduce BMI are likely to provide long-term benefits in disease progression and complication prevention.

An additional strength of the present study is the assessment of waist circumference, which serves as an important marker of central obesity and visceral adiposity. The significant reduction in waist circumference observed after treatment suggests a decrease in visceral fat accumulation. This finding is clinically important because visceral adiposity is strongly associated with insulin resistance, systemic inflammation, and cardiovascular risk. Müller et al. proposed that GLP-1 receptor agonists exert effects on hypothalamic appetite centers and energy balance pathways, leading to reductions in both overall and visceral fat mass.[24] The present findings support this mechanistic explanation and suggest that GLP-1 receptor agonists may contribute to favorable changes in body composition.

The beneficial effects of GLP-1 receptor agonists on lipid metabolism observed in the present study are also noteworthy. Significant reductions were observed in LDL cholesterol and triglyceride levels following treatment. Dyslipidaemia is a major cardiovascular risk factor in patients with T2DM and contributes substantially to the development of atherosclerotic cardiovascular disease. The reduction in LDL cholesterol from 122 mg/dL to 104 mg/dL and the decline in triglycerides from 188 mg/dL to 159 mg/dL indicate that GLP-1 receptor agonists provide benefits extending beyond glycaemic control.

These findings are consistent with those reported by Sattar et al., who demonstrated that GLP-1 receptor agonists improve multiple cardiovascular risk factors, including lipid abnormalities, blood pressure, and inflammatory markers.[21] Improvements in lipid profiles may partly explain the cardiovascular benefits observed in large cardiovascular outcome trials involving GLP-1 receptor agonists. Consequently, the lipid-lowering effects observed in the present study may have important implications for long-term cardiovascular risk reduction.

The proportion of patients achieving clinically meaningful treatment targets further underscores the effectiveness of GLP-1 receptor agonists. Nearly half of the participants achieved HbA1c levels below 7%, while approximately one-third achieved weight loss exceeding 5% of baseline body weight. These outcomes are highly relevant because current diabetes management guidelines emphasize individualized treatment goals that encompass both glycaemic and weight-related targets. Frias et al. similarly reported that GLP-1 receptor agonists enable a substantial proportion of patients to achieve clinically significant improvements in both metabolic and anthropometric outcomes.[22]

The comparative analysis presented in [Table 6] demonstrates remarkable consistency between the present study and major international trials. Wilding et al., Pratley et al., and Sattar et al. all reported reductions in HbA1c and body weight that closely mirror those observed in the present investigation.[19–21] Such consistency enhances the external validity of the findings and suggests that the benefits demonstrated in controlled clinical trials can be successfully translated into routine clinical practice.

The favorable safety profile observed in this study is another important consideration. Gastrointestinal adverse effects, including nausea and transient gastrointestinal discomfort, were the most commonly reported side effects and occurred in approximately 20% of participants. These findings are comparable to those reported in previous studies and are generally considered manageable through gradual dose escalation and patient counselling.[22] Importantly, the low incidence of hypoglycaemia observed reinforces the safety advantages of GLP-1 receptor agonists compared with several traditional antidiabetic therapies.

Emerging evidence also suggests that GLP-1 receptor agonists may exert direct cardiovascular and renal protective effects independent of glycaemic control. Proposed mechanisms include improvements in endothelial function, reductions in oxidative stress, modulation of inflammatory pathways, and enhancement of vascular homeostasis.[21] Although these outcomes were not directly assessed in the present study, the observed improvements in weight, waist circumference, and lipid profile suggest that similar mechanisms may have contributed to the overall metabolic benefits.

Overall, the findings of the present study strongly support the role of GLP-1 receptor agonists as comprehensive metabolic therapies capable of addressing multiple pathophysiological aspects of T2DM. Their ability to improve glycaemic control, reduce body weight, decrease visceral adiposity, improve lipid parameters, and maintain a favorable safety profile positions them among the most valuable therapeutic options currently available. These findings further support current international recommendations advocating the early use of GLP-1 receptor agonists in patients with T2DM, particularly those with obesity, inadequate glycaemic control, or elevated cardiometabolic risk. Future long-term studies evaluating cardiovascular outcomes, renal protection, quality of life, and cost-effectiveness will further clarify the full therapeutic potential of this important class of medications.

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# CONCLUSION

The present study demonstrates that GLP-1 receptor agonists significantly improve glycaemic control, promote clinically meaningful weight reduction, reduce central obesity, and improve lipid parameters in patients with Type 2 Diabetes Mellitus. The reductions observed in HbA1c, body weight, BMI, waist circumference, LDL cholesterol, and triglycerides confirm the multifaceted metabolic benefits of this therapeutic class. These findings strongly support the use of GLP-1 receptor agonists as an effective treatment strategy for patients with inadequately controlled T2DM, particularly those with overweight or obesity.

**Limitations**

The study was conducted at a single tertiary care center, which may limit the generalizability of the findings. The sample size, although adequate for statistical analysis, may not fully represent broader patient populations. The six-month follow-up period may not capture long-term cardiovascular and renal outcomes. Variations in background antidiabetic therapy and lifestyle adherence may have influenced treatment response. Additionally, cardiovascular outcome measures and quality-of-life assessments were not included.

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