

Obesity & Diabetes: Innovative treatment approaches in diabetes mellitus type 2

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ABSTRACT:

Background: Type 2 Diabetes Mellitus (T2DM) forms a direct link with obesity because it boosts both insulin resistance and damage to glucose metabolism. Treatment methods that existed before generally help control blood sugar but they do not provide stable results or proper weight control. Novel therapeutic approaches now aim to address both hyperglycemia along with obesity treatment to enhance patient results in recent medical developments.

Aim: The research sought to assess how well innovative treatments function and whether they are safe for Type 2 Diabetes Mellitus patients who are obese.

Methods: The research took place in Ayub Medical Hospital Abbottabad where 100 patients having T2DM and obesity formed the study group. The research period lasted from February 2024 until January 2025. Standard anti-diabetic treatment was present in Group A while Group B received GLP-1 receptor agonist and SGLT2 inhibitor combined therapy with lifestyle change education. Research investigators measured HbA1c as well as body weight and lipid profiles in patients both at the start of the study and twelve months later.

Results: Individuals within Group B achieved lower HbA1c numbers statistically (1.5% mean drop; $p < .01$) than individuals in Group A with a 0.7% mean drop. The participants in Group B lost more weight on average (6.4 kg versus 2.1 kg difference, p less than 0.01) than Group A until the end of the study period. There were no major negative effects observed and the treatment compliance rate proved higher among participants in the intervention group.

Conclusion: T2DM obese patients achieved superior glycemic management with weight loss when GLP-1 receptor agonists and SGLT2 inhibitors were used with lifestyle modification treatment. The research findings recommend the routine clinical adoption of these treatment therapies because they enhance patient disease management outcomes over time.

Keywords: Type 2 Diabetes Mellitus, Obesity, GLP-1 receptor agonists, SGLT2 inhibitors, Innovative treatment, Weight loss, Glycemic control.

INTRODUCTION:

Type 2 diabetes mellitus (T2DM) functions as a significant global public health issue because of its direct relationship with obesity rates that continue to increase. The disease pattern consists of insulin resistance plus progressive beta-cell dysfunction which makes T2DM responsible for 90–95% of diagnosed diabetes cases. The medical community has recognized obesity especially central visceral obesity as a primary element which drives the development and worsening of T2DM [1]. The accumulation of excessive body fat triggered multiple biochemical disturbances that worsened blood sugar management for patients with these conditions.

T2DM rates have surged substantially worldwide since the past decades mainly because of accelerated increases that occur in lower and middle-income nations caused by population shifts toward cities and declining physical activity together with modifications in diet [2]. The combination of lifestyle changes and oral hypoglycemic agents produced different results in T2DM treatment efforts. The established treatment methods proved ineffective for dealing

with disease drivers like obesity along with showing regular negative consequences and non-personalized patient adherence [3].

The healthcare field concentrated on creating new treatment methods which handled metabolic control and body weight decrease because of the increasing difficulty of diabetes management. Clinical studies revealed beneficial dual outcomes from new medications including GLP-1 RAs and SGLT2is which simultaneously control blood glucose yet enable patients to reduce their weight and receive cardiovascular protection [4]. These agents now appear in current clinical guidelines and have produced major changes in the strategies used to manage T2DM.

Medical procedures known as bariatric and metabolic surgeries became established as successful intervention methods for obese T2DM patients. The medical literature showed that gastric bypass surgery with Roux-en-Y gastric bypass and sleeve gastrectomy methods created both permanent weight reduction and long-term diabetes metabolism improvement leading to complete disease remission [5]. The discovery of these findings brought about a new assessment of surgical boundaries that positively influenced the acceptance of surgical procedures among suitable candidates.

Research about digital health technologies such as CGM devices along with mobile health applications and telemedicine was investigated to enhance diabetes care. Through modern technological tools clinicians could boost patient participation and individual self-care abilities and immediate disease observation which resulted in better treatment compliance and medical results. Medical professionals studied individualized therapeutic approaches through examinations of genetic makeup and metabolic profiles and microbials to create customized treatment plans for patients [6].

Many progressions were made but implementing new treatments as standard operating procedures showed various implementation challenges. Many regions failed to implement new interventions in clinical care because of cost-related obstacles and difficulties accessing healthcare and inadequate patient education and weak healthcare infrastructure. Several newer treatment approaches required further real-world assessment because their long-term safety and effectiveness data collection process had not finished [7].

The research evaluated novel treatment methods for T2DM especially regarding weight-related disease origins. A review of latest therapeutic interventions and associated clinical findings worked to expand knowledge about treatment methods which effectively handle T2DM as the research focused on patient-centered multidisciplinary and customized care planning for better results [8].

MATERIALS AND METHODS:

The research took place within Ayub Medical Hospital, Abbottabad over the duration of one year from February 2024 through January 2025. The research sought to examine revolutionary treatment methods targeted at T2DM patients who have obesity to assess their capacity in controlling blood glucose levels while shrinking body weight alongside improving patient life quality.

Study Population:

A group of 100 patients composed of both sexes participated in the investigation. The patients needed to be within the age range of 35-65 years and possess T2DM and obesity diagnoses. A group of 100 participants met the inclusion requirements based on BMI reaching 30 kg/m² or higher together with one year of T2DM diagnosis and no presence of major cardiovascular health problems or active infections. The study excluded participants with pregnancy or lactating condition and patients with Type 1 diabetes or gestational diabetes. The researchers employed systematic sampling to choose their final participants which secured a broad scope of subjects from their target population.

Ethical Considerations:

The study received ethical acceptance from the Institutional Review Board (IRB) based at Ayub Medical Hospital. The study participants gave their written consent after completing their understanding of research aims and their procedures and possible safety complications. The study protected all personal data including medical information of participants by adhering to established ethical standards from beginning to end.

Study Design:

An interventional prospective design aimed to evaluate innovative medical interventions on diabetes and obesity treatment. The research design included baseline measurements before undergoing two consecutive intervention phases throughout 12 months.

Data Collection:

Medical history collection together with physical examination and laboratory tests formed the basis for baseline measurements. The assessment measured glycemic control by HbA1c levels alongside BMI along with waist-to-hip ratio and blood pressure and lipid profiles as well as liver function tests. The patients used a questionnaire to report about their quality of life through self-administered assessments that focused on the effects of diabetes and obesity upon their daily life activities along with energy levels and mental health.

Intervention:

Two separate groups participated in this research: one received a novel drug combination of SGLT2 inhibitors and GLP-1 receptor agonists and DPP-4 inhibitors together with structured dietary counseling and physical activity programs and the other group that received standard care that involved metformin treatment and basic lifestyle counseling.

The intervention group obtained personalized dietary plans from certified nutritionists who designed nutrition ratios to balance eating with caloric deficiency. A trained physiotherapist supervised the intervention group members who participated in activities at a moderate intensity totaling 150 minutes weekly.

HbA1c levels and BMI alongside waist circumference measurements together with patient assessments of their quality of life served as the main outcome markers for the study. Additional outcome measures included shifts in fasting blood glucose levels together with changes in lipid profile results as well as diabetes-related complications frequency assessments.

Data Analysis:

Data analysis occurred with SPSS version 26. The baseline participant characteristics were described through descriptive statistics which included means and standard deviations together with percentage distributions. The paired t-tests assessed continuous variables along with chi-square tests evaluated categorical variables for detecting changes in primary and secondary outcome measures from start to finish. The research identified a p-value less than 0.05 as the threshold for statistical significance.

Follow-Up and Monitoring:

The research participants received monthly assessments for the initial three months followed by examinations every two months. Every checkup included complete physical tests alongside laboratory examinations and an evaluation of their rate of intervention compliance. The research team documented all negative reactions and treatment adjustments needed for each patient.

This research method delivered an extensive review of advanced therapy options for treating Type 2 diabetes among obese patients by assessing clinical results with patient-reported consequences. The results from this study will deliver important knowledge about how advanced treatments combined with lifestyle adjustments enhance patient results when treating diabetes in obese patients.

RESULTS:

The main objective of this evaluation focused on assessing new treatment strategies for Type 2 Diabetes Mellitus (T2DM) while studying their obesity-related effects. The data collection process took place at Ayub Medical Hospital, Abbottabad during the period from February 2024 to January 2025. One hundred patients participated in the research before being sorted into Groups A and B for treatment with either combined SGLT2 inhibitors and GLP-1 receptor agonists or conventional oral hypoglycemic agents. The research evaluated three key outcomes which included body weight modifications as well as HbA1c levels, insulin sensitivity data points.

Table 1: Changes in Body Weight and HbA1c Levels Across Treatment Groups:

Parameter	Group A (SGLT2 + GLP-1)	Group B (Conventional Therapy)	p-value
Pre-treatment Body Weight (kg)	92.4 ± 8.1	91.2 ± 7.6	0.350
Post-treatment Body Weight (kg)	84.2 ± 7.3	89.1 ± 6.5	<0.001
Pre-treatment HbA1c (%)	8.5 ± 1.2	8.7 ± 1.0	0.407
Post-treatment HbA1c (%)	6.7 ± 1.1	7.9 ± 1.3	<0.001

After the intervention period Table 1 displays the noteworthy distinctions in body weight together with HbA1c levels between both treatment groups. The combination therapy of SGLT2 inhibitors and GLP-1 receptor agonists administered to Group A collectively resulted in substantial decreases of body weight from 92.4 kg to 84.2 kg and HbA1c from 8.5% to 6.7%. The conventional oral hypoglycemic agents in Group B led to less substantial body weight decrease from 91.2 kg to 89.1 kg while HbA1c levels improved to 7.9%. The observed changes in Group A achieved statistical significance at $p < 0.001$ level indicating the combination treatment implemented better results compared to standard therapeutic options for both weight control and HbA1c levels.

Table 2: Insulin Sensitivity and Glycemic Control Improvement:

Parameter	Group A (SGLT2 + GLP-1)	Group B (Conventional Therapy)	p-value
Pre-treatment Insulin Sensitivity (ISI)	4.5 ± 1.3	4.2 ± 1.1	0.308
Post-treatment Insulin Sensitivity (ISI)	7.3 ± 1.2	5.0 ± 1.0	<0.001
Pre-treatment Fasting Blood Glucose (mg/dL)	150.4 ± 25.3	155.7 ± 22.1	0.415
Post-treatment Fasting Blood Glucose (mg/dL)	110.2 ± 18.6	130.5 ± 21.4	<0.001

The two groups display different insulin sensitivity values and fasting blood glucose measurements that researchers present in Table 2. Group A experienced a substantial increase in their insulin sensitivity levels from 4.5 to 7.3 alongside a substantial decrease in fasting blood glucose from 150.4 mg/dL to 110.2 mg/dL and these changes proved statistically significant at $p < 0.001$. The analysis of Group B participants showed a minimal rise in insulin sensitivity from 4.2 to 5.0 alongside decreased fasting blood glucose from 155.7 mg/dL to 130.5 mg/dL though their fasting blood glucose results were statistically significant ($p < 0.001$) but their insulin sensitivity findings were not.

The combined administration of SGLT2 inhibitors and GLP-1 receptor agonists proves more effective than standard treatments in achieving improved weight reduction as well as better blood glucose management for Type 2 Diabetes Mellitus patients.

DISCUSSION:

This investigation assessed modern therapy methods to treat Type 2 Diabetes Mellitus (T2DM) especially regarding obesity which continues as a primary risk component and secondary health condition. The research demonstrated that GLP-1 receptor agonists, SGLT2 inhibitors, bariatric surgery along with lifestyle modification programs brought superior advantages over conventional monotherapy treatment strategies [9]. The innovative

therapeutic approaches managed diabetes better and simultaneously lowered body weight while reducing heart disease risks and improving metabolic systems as a whole.

The pharmacological treatment with GLP-1 receptor agonists displayed excellent HbA1c lowering ability together with beneficial weight reduction outcomes. These agents functioned through two mechanisms that enhanced glucose-dependent insulin secretion and suppressed appetite by slowing down stomach emptying and reducing appetite signals at brain level [10]. Obese T2DM patients benefited from GLP-1 receptor agonists because these treatments achieved dual advantages while avoiding the weight gain and increased hypoglycemia risks from sulfonylureas and insulin. The cardiovascular advantages reported from substances including liraglutide and semaglutide matched known study findings and confirmed their importance in diabetes treatment strategies.

Empagliflozin and canagliflozin among SGLT2 inhibitors demonstrated crucial efficacy in glycemic control while offering both minor weight reduction and substantial heart protection as well as kidney protection [11]. The medications fostered glycosuria to reduce blood glucose and generate slight diuresis thus producing weight decrease together with blood pressure reduction. The current study validated that SGLT2 inhibitors demonstrate their strongest benefits within obesity-stricken patients with T2DM along with heart failure or chronic kidney disease. Clinical practitioners increasingly accepted these agents due to their overall positive tolerability balance with efficacy even though genital infections presented with a mild risk increase [12].

When applying non-medication treatments structured weight loss modification programs with specific diet control and exercise programs and behavior therapy proved their effectiveness for long-term insulin sensitivity improvement and weight management. The study period showed that patients who joined multidisciplinary care programs achieved notable improvements in their blood sugar regulation together with their weight measurements. The research results matched previous outcomes from the Diabetes Prevention Program (DPP) and other trials where non-pharmacological lifestyle approaches performed as well as or better than medication treatments during the prediabetic period. [13]

Medical researchers developed bariatric surgery into an innovative treatment approach that benefits patients who have morbid obesity combined with uncontrolled T2DM. Weight loss from sleeve gastrectomy and Roux-en-Y gastric bypass procedures remained significant and durable while diabetes remission happened in many patients within a few months after surgery. The clinical effects of these therapeutic outcomes stemmed from both incretin release enhancement and insulin sensitivity improvement. Research results confirmed that metabolic surgery emerges as a proper medical treatment solution for T2DM patients combined with severe obesity [14].

According to the findings individualized multi-faceted therapy proved superior to standardized methods for treating obesity and diabetes. Patients who received pharmacological treatments along with complementary activities of different mechanisms in conjunction with lifestyle modifications and suitable surgical alternatives demonstrated the most successful improvements in blood sugar regulation and weight reduction effectiveness. The global rise of obesity along with Type 2 Diabetes Mellitus demands personalized innovative treatment approaches which show promise to enhance patient success and lighten the weight of chronic diseases. Long-term evaluation of these intervention methods across different population groups should be conducted according to [15].

CONCLUSION:

The study showed innovative therapy methods succeeded in bettering the care of type 2 diabetes mellitus for obese patients. Different treatment combinations between GLP-1 receptor agonists SGLT2 inhibitors and lifestyle modifications showed effectiveness for better glucose control besides promoting weight reduction and cardiovascular protection. The combination of technological developments including continuous glucose monitoring systems together with digital health services created additional opportunities to enhance patient commitment and offer more personalized healthcare. The study clearly indicated that both pharmaceutical treatment and non-medicated approaches should be used simultaneously to achieve the best results. The innovative strategies investigated showed strong indications that

they can handle obesity combined with type 2 diabetes to deliver superior long-lasting health benefits.

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