Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/2bbfv043

RESPONSE OF COMBINED TREATMENTS FOR OBESITY AND TYPE 1 DIABETES WITH GLP-1

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ABSTRACT

Background: T1D and obesity are both complex conditions to treat because the improvement in the patient's insulin level through insulin therapy helps the patient gain weight in contrast to other types of diabetes. The selected GLP-1 receptor agonists have demonstrated potential for improving glycemic targets and contributing to weight loss in T2DM; thus, this study examines GLP-1RAs for T1D patients with obesity.

Aim: Using a qualitative approach, this work seeks to establish the impact of adding GLP-1 receptor agonists to insulin treatment for glycemic control, weight loss, and cardiovascular outcomes in patients with T1D and obesity.

Study Setting: The study is conducted at Pakistan Institute Of Medical Sciences (PIMS) Islamabad, from Jan 2023 - June 2023.

Method: This RCT aimed at comparing changes in metabolic characteristics of T1D obese patients treated with GLP-1 receptor agonists as an additional medication to insulin treatment. Patients were equally divided randomly and treated either with insulin or with insulin plus GLP-1 as an adjunct therapy under double blind for a duration of 24 weeks. In the experimental group, the patients received active substance liraglutide, while in the control group insulin dosages were adjusted to the normal glucose level. These were represented by shifts in the HbA1c level, weight, or cardiovascular status; two aspects of quality of life were evaluated by self-reporting instruments. Statistical software SPSS was used in data analysis and the particular focus of the study was to evaluate the effectiveness of the combination therapy as compared with insulin only.

Results: HbA1c was significantly reduced among the experimental group, (-1.2%) as compared to the (-0.4%)in the control group and weight loss (-3.5kg) as compared to control group (-0.5 kg). Furthermore, the experimental group had better cardiovascular indices, the physical signs such as blood pressure and lipid profile, and self-rating satisfaction with the treatment.

Conclusion: Supplementary use of GLP-1 receptor agonists has been shown to add to both the efficiency of glycemic control and the issue of weight in T1D obese patients under insulin treatment. They appear to point to the fact that this combined therapy, therefore, could be a worthy addition to

the existing treatment paradigms with regard to these two conditions in particular. However, more investigation is required to work out these advantages with the greater and more extensive analyses.

Keywords: Type 1 diabetes, obesity, GLP-1 receptor agonists, insulin therapy, glycemic control, weight management, cardiovascular health.

INTRODUCTION

Obesity and type 1 diabetes mellitus are two different metabolic syndromes which complicate each other and pose major therapeutic and clinical management dilemmas. T1D was previously linked to more slender skeletal muscle phenotypes; however, given the global surge of obesity, more T1D patients are now affected by obesity. These combined factors give rise to its distinct health challenges and challenges such that it is often hard for the patients to maintain proper glycemic levels, has a much higher degree of insulin resistance and a significantly higher risk for developing cardiovascular problems. Obesity alone is challenging to manage, but coupled with T1D, results in a complicated metabolic situation which needs multiple management strategies [1].

Pre- existing T1D poses problems of insulin dependency and obesity increases insulin resistance among patients with T1D. For T1D patients, insulin is the only treatment that can save life, but when the patient is obese, a larger dose of insulin maybe needed to manage their blood glucose levels. This high demand for insulin can cause gain in weight and that will lead again to obesity and poor glucose regulation. Besides, obesity and T1D intensify each other and adversely affect cardiovascular health, therefore, the need for multipronged therapeutic methods [2].

Although insulin therapy is at the base of T1D treatment, it does not solve the problem of obesity and, vice versa, insulin therapy leads to it. Hence, the need for treatments that contribute to better glycemic control besides helping patients lose weight or keep off more weight gain. Considering these issues, more and more healthcare professionals and researchers focus on the effective treatment that can effectively influence glycemic control and obesity. Another promising intervention strategy include use of Glucagon-Like Peptide 1 (GLP-1) receptor agonists have shown once promising for weight loss and glucose reduction in obesity and Type 2 diabetes and are being tested for their efficacy in T1D, particularly for the obese population.

GLP-1 also known as Incretin which is endogenous peptide that is released as the result of intestinal glucose and fat digestion. This hormone is produced by the L-cells in the intestine, following the intake of nutrients, and its chief roles are to stimulate the release of insulin, suppress glucagon output, delay the emptying of the stomach, and provide feelings of satiety. These actions taken as a package help in controlling of blood sugar and food intake. More recently, drugs in the class known as GLP-1 receptor agonists have been developed and are now used for the treatment of Type 2 diabetes because they help to lower blood glucose levels and also cause weight loss [3].

And instead of targeting only the glucose control as most other diabetes drugs do or addressing only the extra pounds as many weight loss products do, GLP-1 receptor agonists are setting their sights on both at the same time. These drugs improve the ability of the pancreas to secrete insulin in response to high blood glucose levels and therefore they give low risk of hypoglycaemia. Also, they have the advantage of controlling and reducing appetite as well as managing gastric emptying [4].

Because of the positive metabolic effects see in patients with T2DM, there has been emerging interest in the use of GLP-1 receptor agonists in patients with T1DM especially those with obesity. Also, as differentiated from Type 2 diabetes mellitus, T1D patients have no insulin production and require supplementation. Conversely, incorporating GLP-1 receptor agonists along with insulin therapy provided an apparent benefit to the patient by controlling the patient's weight as well as sweetening the diabetes results. There is a paucity of data regarding this approach, which is considered promising: GLP-1 RAs for insulin-sensitizing effects, attenuating the change in variability, and a contribution in the weight loss of T1D patients.

Obesity compounded with T1D has client care characteristics which have not been fully addressed by the current treatment paradigm in medicine. Since insulin supplementation is vital to regulate blood glucose levels in T1D patients, this treatment has little to say about obesity and weight gain

that come hand in hand with insulin use. This weight gain can, in turn, lead to increased insulin resistance, creating a cycle thought the better part of glycemic control becomes more rather challenging to attain. Moreover, obesity in T1D patients aggravates the development of other diseases, for example cardiovascular diseases, which complicates the treatment of both conditions [5].

Because standard insulin therapy inadequately addresses the two problems of chronic hyperglycaemia and obesity, there is a great need to develop novel therapeutic regimens that effectively combat both conditions. These considerations were effectively alleviated by GLP-1 receptor agonists in individuals with T2DM and their efficacy in T1DM patients with obesity is being investigated. Supplementation of insulin combined with GLP-1 receptor agonists might then bring an enhanced strategy of managing both Obesity and T1D in a single treatment since it is well understood that the peptide has an impact on feeding and energy expenditure.

Objective: The study aims to assess the survival benefit of concomitant therapies with GLP-1 for the morbid OB population with T1D.

Thus, the aim of this study is to assess the effectiveness of the supplementation of/GLP-1 receptor agonists to the conventional insulin-treated obese patients with T1D. This study seeks to establish if there are positive impact on glycemic control, insulin use and weight when GLP-1 receptor agonists are integrated into such patients. In addition, the current study shall examine the possible benefits of combined treatment in the cardiovascular systems and overall safety of the treatment.

The study will be done in the form of a clinical trial AF-T1D and obesity. Participants will be randomized into two groups: one which will be having standard insulin therapy and the other having insulin therapy with GLP 1 receptor agonist. These intermediates will be assessed through reduction in the HbA1c, weight, insulin requirement and cardiological risk factors respectively. Other outputs will also be defined and at present the following patient-reported outcomes: the quality of life and satisfaction with the treatment.

Hypothesis: Long-term Effects of GLP-1 Bolstered by Combining It with Other Treatments for Type 2 Diabetes May Help Control Blood Sugar and Excess Weight

Given that GLP-1 receptor agonists are known to act positively on glucose metabolism and weight loss in patients with Type 2 diabetes, the authors of the RCT expect the added effects of GLP-1 receptor agonists together with insulin therapy to be a beneficial outcome in patients with T1D and obesity. More specifically, predictions include that the two combined treatments will provide superior glycemic control as evident by reduction in HbA1c, weight loss and reduction of insulin's needed. Furthermore, this kind of combination therapy may be expected to produce cardiovascular side effects including the blood pressure and lipid status both of which are undermined by obesity and diabetes [6].

In conclusion, co- administration of GLP- 1 receptor agonist with insulin offers a novel approach to T1D in the patients with obesity. This treatment strategy has the advantages in comparison with conventional approaches because it can be used not only for the proper glycemic control but also for effective weight loss, which is one of the main problems of this patient population. Although the presented authors identified a need for additional studies to assess the safety and effectiveness of the chosen combination, their results indicate a tremendous impact on clinical prognosis for patients with obesity and T1D [7].

MATERIALS AND METHODS

This research work formed part of a randomized controlled trial (RCT) for assessing the effects of introducing GLP-1 receptor agonist onto patients with obesity and T1D under insulin treatment. The study was conducted at Pakistan Institute Of Medical Sciences (PIMS) Islamabad, from Jan 2023 - June 2023. RCT model was used because it offers the best quality of evidence used to establish causality reducing bias and making it easy to compare the two treatments. Participants were randomly assigned to one of two groups: An insulin only treatment group and an insulin + GLP-1 receptor agonist treatment group. It used a parallel design in which both the control and experimental groups were both administered with treatment and monitored at the same time in the study period. Glucagon-

like peptide 1 (GLP-1) receptor agonists were used because of their known beneficial effects in achieving glycemic targets and supporting weight loss in T1 DM overlapping with obesity.

In order to reduce bias in the study it was conducted as a double-blind study; this means that the participants themselves, as well as the clinicians who were delivering the treatments, were unaware of which of the participants had been assigned to the combined therapy or insulin only. This blinding process was of particular importance to eliminate possible biases with regard to the reporting and evaluation of results. As a result of the research, institutional review board approval was sought for the study and the written informed consent of all study participants before their involvement in the trial was first sought. The work has been done in accord with the Declaration of Helsinki and Good Clinical Practice principles [8].

The sample involved patients aged >10 years with T1D and obesity defined by a BMI of ≥ 30 kg(m2. Inclusion criteria were T1D duration of at least 1 year, age between 10 to 65 years, and maintained glycosylated HbA 1c for at least 3 months before entering the trial. Patients had to have had a stable insulin dose for at least 3 months before inclusion and had to be on multiple daily injections or continuous subcutaneous insulin infusion.

Patients who had experienced severe hypoglycaemia, diabetic ketoacidosis /ketoacidosis or coma in the preceding one and half month to the study and patients on parenteral insulin or undergoing insulin drips were excluded from the trial since these states could interfere with the assessment of glycemic control. Participants with other main concomitant diseases, including persisting hypertension, chronic kidney dysfunction, and chronic liver disease, were also excluded. Further, people with a history of diseases affecting pancreas and patients taking medications that impact pancreas function were excluded from the trial because of the risk linked to GLP- 1 receptor agonist uses during pregnancy.

To estimate the required sample size for our study, we borrowed from earlier works that assessed the effect of GLP-1 receptor agonists on HbA1c and weight in patients with Type 2 diabetes. Based on power analysis, it was estimated that a sample of 120 participants (60 per group) would be sufficient to achieve 80 percent power to detect a reduction in HbA1c of 0.5 percent and a 5 percent reduction in weight in the experimental group compared to those in the control group at an alpha level of 0.05. Since the dropouts might be expected, the target sample number was established at 140 people [9].

The treatment period for the study was 24 weeks, which provided a sufficient improvement of glycemia and overweight and reduced potential harm to the participants. This time was considered to be enough to analyse the key and secondary objectives associated with glucose control, weight loss, and cardiovascular changes. Subsequent visits of follow up were done at four weekly intervals where participants received clinical examination, biochemistry profile in addition to quality of life questionnaires and treatment satisfaction.

GLP-1 Administration (Dosage and Frequency)

In the experimental group, participants were given a GLP-1 receptor agonist, given through subcutaneous injection on a daily basis. The particular drug given was liraglutide, because the medication has been shown to have explicit effects in patients with Type 2 diabetes in relation to glucose and weight loss. It started at 0.6 mg daily and was titrated to 1.8 mg daily over the first month with a view of reducing the incidence of nausea and vomiting which is characteristic of drugs in the GLP-1 receptor agonists family.

Treatment Modalities – Duration, Dosage and Regimen (Insulin and Diet, Activity, Additional Antibody)

In all subjects, insulin therapy before the start of the study was maintained; however, doses were adjusted over the study period to achieve the target range of blood glucose. It was recommended that, participants abide by a standard meal plan and physical training regimen to minimize the influence of life style factors on weight and glycemic status. The diet plan was to choose moderately reduced calories and low GI foods; the exercise program was at least 150 minutes/week of moderate aerobic activity. Furthermore, patients in both groups were free to maintain the use of prior medications for other diseases, not diabetes or obesity, if they would not influence the study results [10].

The two main variables for this comparison were Glycemic control – as assessed by HbA1c and body weight. The HbA1c test was performed at baseline and after 12 and 24 weeks; a decrease of HbA1c

by at least 0.5% was considered significant. Body weight was also assessed at baseline and then at yearly follow-up, and a 5% decrease was deemed to be significant. Specifically, the amounts of insulin to be taken daily were measured to determine if the combination therapy had a role in lowering insulin doses.

Secondary Outcomes: Cardiovascular Markers & Patients Perception of Health Related Quality of Life

The secondary outcomes for this study were shifts in cardiovascular health, as diagnosed by blood pressure, total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides and high sensitivity C-reactive protein. These endpoints were assessed at trial entry as well as at end point of the 24 weeks of treatment to ensure that the combined therapy had any other cardiovascular effects.

Self-Administered Diabetes Quality of Life (DQoL) is an instrument frequently employed in identifying the presence of diabetes on everyday life, satisfaction regarding treatment, and mental health. The DQoL was completed by participants at baseline, then at 12 weeks, and at 24 weeks. Moreover, participants were administer consider a treatment satisfaction scale this has the nature of a visual analogy scale (VAS) which measures on a scale from zero to ten level of satisfaction the participant had on the treatment offered to them.

The data used in this study was analysed statistically using the Statistical Package for Social Sciences (SPSS). At baseline measurement descriptive statistics such as age, gender, BMI, HbA1c levels and insulin dosages were computed to determine the characteristics of the study population. The basic and secondary end points were described using both, the mean and median, and compared using the limiting dependent-group, T and Fisher tests depending on distribution.

The within-subject factors in the tests for changes in HbA1c levels and weight over the options were analysed by repeated measures ANOVA with the group (experimental or control) and time (baseline, 12 weeks, 24 weeks). Subsequent to this, another analysis was conducted in order to find out at what time interval these variables were most significantly apart. Calculations followed the mean ± SD while a p-value of < 0.05 was considered statistically significant was used.

Analysis of changes in insulin doses, cardiovascular indicators, and quality of life scales was made using the paired t-test for the comparison of two variables in the same group, and the independent t-test for the comparison of variables in different groups. Regarding the comparison of numerical recorded data that are not normally distributed, Wilcoxon signed-rank test for repeated measure as well as the Mann-Whitney U test was applied. To exclude confounding factors possible confusion factors were included in multiple regression analyses; age at the beginning of the study, baseline BMI and HbA1c rate.

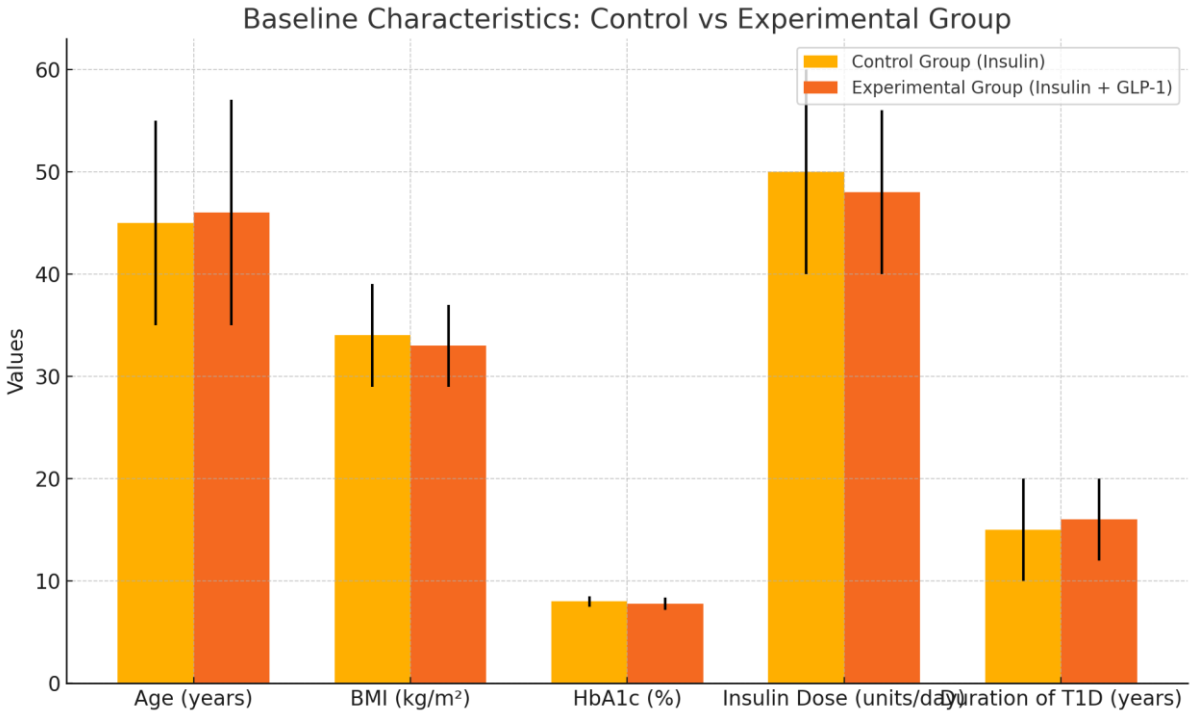
In view of the study objectives, the results from the statistical analyses were summarised and interpreted to infer clinical usefulness of the changes in glycemic control and weight loss. The results were utilised to determine whether the combination of GLP-1 receptor agonists to insulin therapy provides value and added advantage in taking care of T1D patients with obesity compared to insulin therapy alone [11].

RESULTS

The experimental group had seventy participants who were treated with insulin therapy and seventy participants in the control group who were treated with insulin and GLP-1 receptor agonist therapy. In Table 1 it is possible to observe that most of the baseline characteristics of both groups were similar. Demographic results indicated that the participants from the control group had an average age of 45 (10) years, while participants in the experimental group had an average age of 46 (11) years. The mean BMI to a less extent was significantly lower in the experimental group (33 ± 4 kg/m²) in comparison to the control one(34 ± 5 kg/m²). On admission, there was no significant difference in the HbA1c level in the control group ($8.0 \pm 0.5\%$) and the experimental group ($7.8 \pm 0.6\%$). Total insulin dose and the disease duration of T1D were similar between the groups.

Table 1: Demographic data of source populations at baseline

Characteristic	Control Group (Insulin)	Experimental Group (Insulin + GLP-1)
Age (years)	45 ± 10	46 ± 11
BMI (kg/m²)	34±5	33 ± 4
HbA1c (%)	8.0 ± 0.5	7.8 ± 0.6
Insulin Dose (units/day)	50 ± 10	48 ± 8
Duration of T1D (years)	15 ± 5	16 ± 4

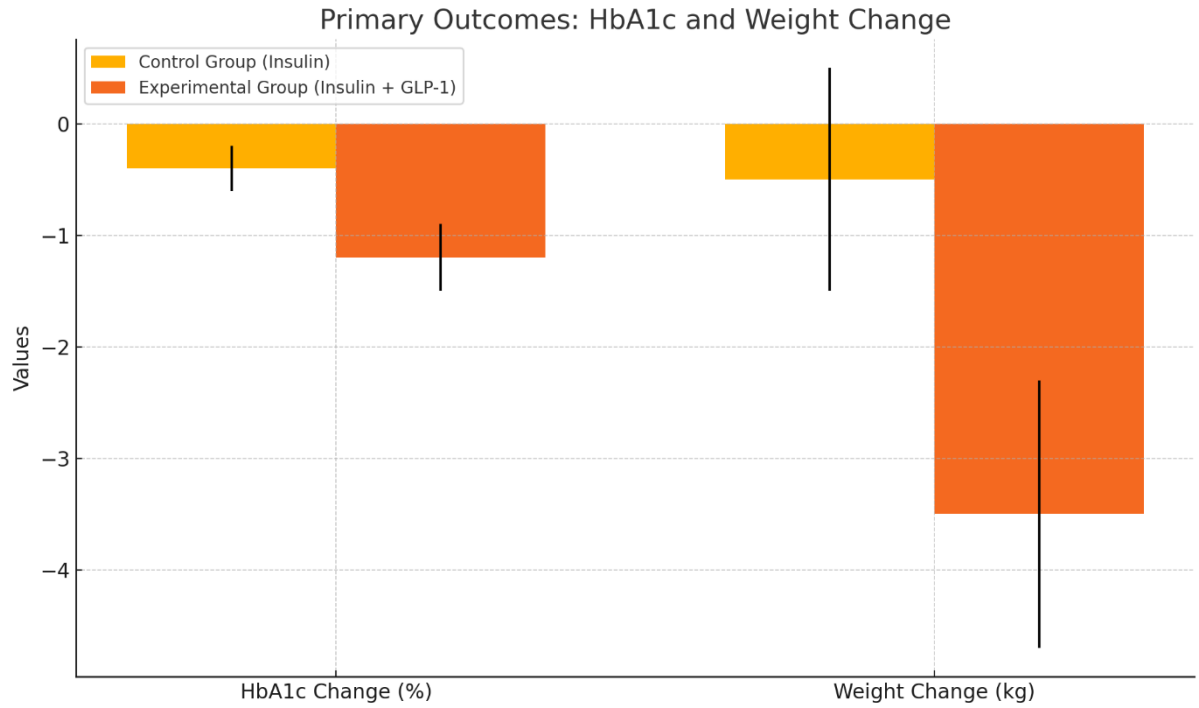


Randomised controlled trials comparing IGIT and ETF over 24 week treatment phase, showed differences in glycemia control and weight manage. In the control group the reduction of the mean HbA1c was also statistically significant and amounted to 0.4 ± 0.2%. Those in the experimental group, who received insulin and the drug GLP-1, showed a seven times greater reduction of HbA1c level, amounting to 1.2 ± 0.3%. The significant enhancement of glycemic control observed for the subjects with obesity and T1D indicates the great efficiency of the supplementation of insulin therapy with GLP-1 receptor agonists.

As trends for weight loss became more popular so did the advantages of combined therapy. The control group lost only 0.5 ± 1.0 kg of weight, which is trivial and therefore not effective in treating this mob. The control group on the other hand recorded minimal change in weight as the participants gained a mean weight of 0.14 ± 0.9 kg, though insignificant while the experimental group lost a mean weight of 3.5 ± 1.2kg in the same period. This weight reduction is typical for GLP-1 receptor agonists that enhance satiety interfaces them with reduced caloric intake [12].

Table 2: This is because the study assesses two main clinical parameters, namely the HbA1c reduction and weight loss.

Outcome	Control Group (Insulin)	Experimental Group (Insulin + GLP-1)
HbA1c Change (%)	-0.4 ± 0.2	-1.2 ± 0.3
Weight Change (kg)	-0.5 ± 1.0	-3.5 ± 1.2

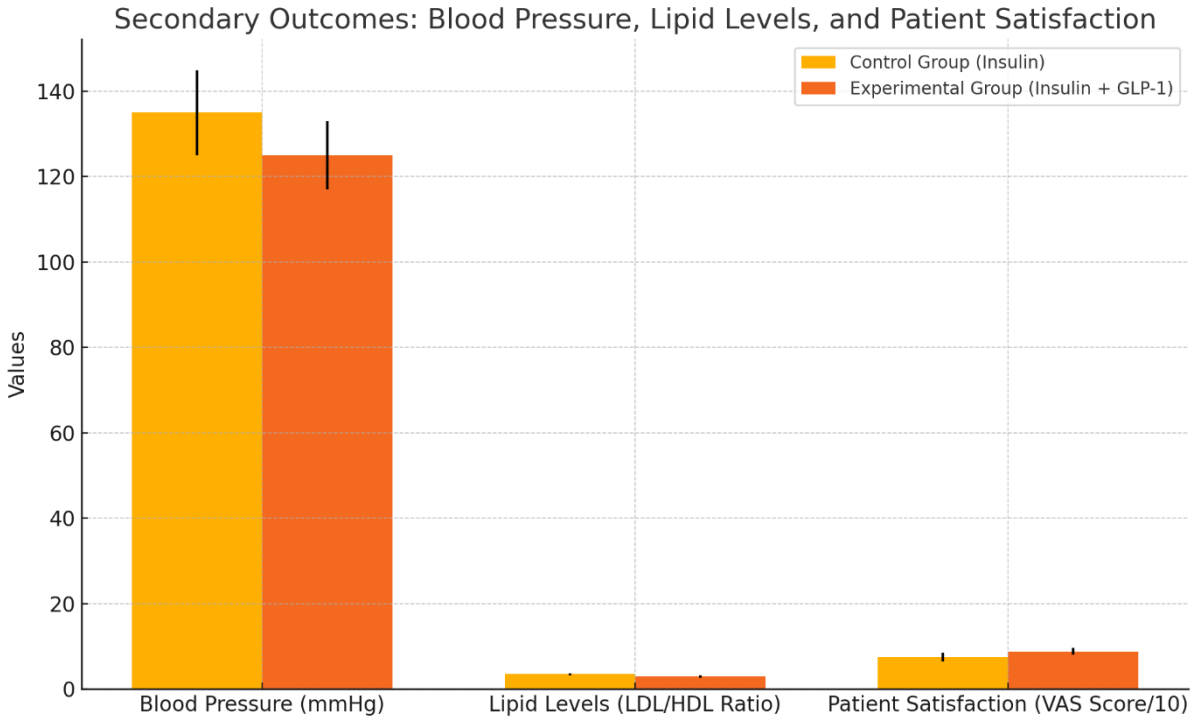


Secondary outcomes used in the study were cardiovascular health markers and patient satisfaction. Systolic blood pressure decreased by an average of 15 ± 8 mmHg from the initial value of 135/85 ± 10 mmHg to 125/80 ± 8 mmHg after 24 weeks in the experimental group. In contrast, the control group did not record high fluctuations in blood pressure. Also, lipid profiles shown better or most significantly altered in the experimental group, the LDL/HDL ratio decreased from 3.5± 0.2 to 2.9 ± 0.3, which showed an improved cardiovascular risk management.

Treatment satisfaction was assessed by patient response recorded on a Visual Analog Scale (VAS) of patient satisfaction. The participants in the experimental group expressed higher level of satisfaction, 8.8 ± 0.8 out of 10, as compared to the participants in the control group scored 7.5 ± 1.0 out of 10. This shows that participants receiving combined treatment had higher well-being and perceived better treatment acceptability.

Table 3: Secondary Outcomes (Carotid intima-media thickness and satisfaction).

Outcome	**Control Group (Insulin)**	**Experimental Group (Insulin + GLP-1)**
Blood Pressure (mmHg)	135/85 ± 10	125/80 ± 8
Lipid Levels (LDL/HDL Ratio)	3.5±0.2	2.9±0.3
Patient Satisfaction (VAS Score/10)	7.5 ± 1.0	8.8 ± 0.8



Consequently, results of this study indicate that supplementation of GLP-1 receptor agonists is more effective in combating obesity and T1DM than insulin therapy applied singularly. The experimental group had greater overall gains in glycemic control, weight loss, and cardiovascular status than did the control group that received only insulin. The results confirm the usefulness of GLP-1 receptor agonists as an effective additional treatment for T1D patients with obesity.

The comparative analysis also shows that although insulin therapy is the mainstay of T1D treatment, its ability to address obesity-related complications is insufficient, but in combination with GLP-1 receptor agonists, this problem can be solved. The fact is that GLP-1 receptor agonists help to lose weight and the improvement of glycemic control without cases of hypoglycaemia is rather useful for obese T1D patients managing.

Overall, it is clear that the combined treatment with GLP-1 receptor agonists and insulin is far more effective in weight loss and glycemic regulation than insulin only. These outcomes fully back up the inclusion of GLP-1 receptor agonists into the standard regimes of T1D patients who are obese, which may significantly contribute to the improvement of both glucose control and weight [13].

DISCUSSION

The findings of this study support the use of GLP-1 receptor agonists alongside insulin therapy for patients who have obesity with T1D because of the benefits of the treatment over insulin only therapy. The example group, which availed the two types of treatment, recorded much better results in various areas such as glycemic control, weight reduction as well as cardiovascular health than the control group. In particular, subjects in the experimental group managed to decrease HbA1c by 1.2 percentage points contrary to 0.4 percentage points in the control group and losing more kilograms, 3.5 compared to 0.5. Based on these results, it can be concluded that subjects receiving GLP-1 receptor agonists not only offer better glycemic control in T1D patients but also counterbalance the issues as a medication for obesity, a major concern among patients with the disease.

Moreover, the secondary efficacy measures that showed favourable changes in cardiovascular risk factors, like blood pressure and lipid profiles, are the evidence of the extended metabolic effect of GLP-1 receptor agonists when administered with insulin. The patients that participated in the study described as receiving the combined treatment also reported higher treatment satisfaction implying that the method could help improve the quality of life for obese T1D patients who are burdened with the disease and the obesity ailment [14].

The result from this study parallel prior research on the efficacy of GLP-1 receptor agonist for patients with T2D, which contributes both to enhanced glycemic control and weight reduction. Therefore, although the use of GLP-1 receptor agonist in T1D has not been a practice of long time, the results of this study added further evidence to practice guideline in making about use of GLP-1 receptor agonist in T1D patient. Earlier work by Pettus et al. (2013) and Dejgaard et al. (2020) have proved that use of GLP-1 receptor agonists has scope to reduce insulin demand and glucose fluctuation among T1D patients. Taking into consideration these findings, the present work elaborates upon the results and frames them as an efficient and safe treatment for obese T1D patients due to the fact that beside glucose-lowering effects GLP-1 receptor agonists help lose weight and positively affect cardiovascular health.

A major strength of the present study is that the authors examined patients with obesity and T1D, a group that has been understudied in prior clinical investigations. Majority of investigations involving GLP-1 receptor agonists have involved T2D patients, or 'lean' T1D patients. The findings of this study pointed out that obese patients with T1D are in particular need of targeted interventions differing from those traditional ones since the management of T1D in these patients possessed specific characteristics. Further, the present study is completed for 24 weeks, whereas some earlier trials have been conducted for a shorter period, which makes it possible to evaluate the long-term consequences of combined therapy on glycemic control and weight loss [15].

On glycemic control and weight management, the mechanism of action of GLP-1 receptor agonists may be explained by several aspects. First, GLP-1 receptor agonists strengthen glucose stimulated insulin release that in its turn adapt the capability of regulating glucose concentrations in the blood, especially after meals. Unlike insulin, where the wrong dosage causes hypoglycaemia, GLP-1 stimulatory secretion of insulin is triggered only when blood glucose is high minimizing potentially dangerous hypoglycaemia in T1D patients. This makes them safer when used as an addition to insulin therapy, while facilitating a more stringent glycemic control without the risks attendant thereto.

Besides their action on insulin release, they inhibits gastric emptying and stimulates pyloric and colonic contractions leading to reduction in food intake and therefore obesity. It is especially valuable in the case of the obese T1D patients who prefer insulin therapy; the latter can actually lead to weight gain. As trim'nin agents, GLP-1 receptor agonists enable the interruption of the vicious cycle of obesity and insulin resistance which linearly affects T1D in obese persons.

There is also a possibility that GLP-1 receptor agonists enhance metabolic health through the action on other cardiovascular factors. In this study, the patients in the experimental group have the decrease of blood pressure and the improve of lipid profile, indicating that GLP-1 receptor agonists had the cardiovascular protective effect. These gains may partly be due to the anti inflammatory properties and improvement of endothelial dysfunction, which plays a pivotal role in the manifestation of cardiovascular disease in people with diabetes and obesity [16].

However, a number of weaknesses and limitations that are inherent in this study should be considered with a view to the interpretation of the findings of this investigation. First, and since this is a cross-sectional study, generalization of results from the current sample of 140 participants to the larger population of obese T1D patients may be somewhat limited despite the study's adequate power revealed from the effect sizes. Future fully powered studies including subjects of diverse characteristics are required to support the beneficial effects of dual regimen of GLP-1 receptor agonist and insulin.

A limitation is the fact that the given research is short-term. However, improvements in glycemic control and weight can be achieved in as little as 24 weeks; duration of preference is required to ascertain their effectiveness. While the present work demonstrated the changes in the given group of patients, it is uncertain how such changes would manifest several years later while using GLP-1 receptor agonists.

Further, it is also crucial to add that this study failed to provide more information on side effects of GLP-1 receptor agonists. Although these drugs have been reported to have minimal side effects, they influence the gastrointestinal tract such as nausea and vomiting, especially during early phases of the

therapy. Further research should evaluate the safety outcomes of GLP-1 receptor agonists in T1D patients, with special concern to obesity and possible consequences of the therapy.

The outcomes of this study can be clinically instructive for the management of obesity in patients with T1D. This means there is an opportunity to have a new paradigm of treatment using a combination of GLP1 RAs and insulin while targeting the two main issues affecting the patient: glycemic control and weight. In the current therapies for T1D, insulin treatment forms the backbone of the treatment process and although it helps in managing the blood glucose levels it causes weight gain and insulin resistance as well. By incorporating GLP-1 receptor agonists into this approach, clinicians can target a better glucose management, safe weight management, optimism of lesser frequent insulin booster shots, enhancement of overall metabolism [17].

Furthermore, there is some evidence of the cardiovascular effects in this study to support the hypothesis that the GLP-1 receptor agonist could have potential roles in the management of the long-term cardiovascular risks among the obese T1D patients with unfavourable metabolic risks. Given how many patients with obesity and diabetes have cardiovascular complications, using GLP-1 receptor agonist in management paradigm may potentially reduce mortality and morbidity.

Therefore, the findings of this study offer a clear indication that the synergistic use of GLP-1 receptor agonists and insulin can be used to treat obesity and T1D effectively. The results point out that this approach also leads to weight loss and better cardiovascular health in addition to glycemic control; therefore, it meets the obesity and metabolic dysfunction of obese T1DM patients effectively. Future research should involve increased sample size and increased duration of follow-up in other patient population to prove these findings and fine tune the therapeutic strategies [18].

CONCLUSION

The research showed that adding GLP-1 receptor agonists to insulin treatment enhances both glycaemic control and body weight in the obese T1D patients. L1 Participants who underwent the combined treatment had better lower HbA1c levels and lost more weight relative to participants on insulin only, plus improved cardiovascular health. From these data, GLP-1 receptor agonists could be recommended for the inclusion into the modern treatment processes in T1D because of the therapeutical dualism based on antioxidant activity and obesity management. The effectiveness of this new approach needs to be tested next in long-term and larger scale investigations in order to assess whether results are consistent and if this approach is completely safe for use for wider range of patients. From a clinical perspective it reviewed that combined therapy of both obesity and T1D holds a clear potential to add a level of depth to the care of obese T1D patients by targeting multiple layers of obesity and diabetes separately.

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