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Original Research Article

Metabolic Effects of Intermittent Fasting in Type 2 Diabetic Patients: A Prospective Observational Study

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Abstract

Background: Intermittent fasting (IF) is gaining interest as an alternative therapy for type 2 diabetes mellitus (T2DM) management. Although commonly proposed for weight loss, the potential of IF may be beyond it with possible benefits on insulin sensitivity, day-to-day glucose management and lipid profile. Clear evidence of benefits has been demonstrated in clinical trials, however evidence from the real-world experience is scarce and usually not published in detail. This experience is even more limited among Indian patients.

Methods: We performed a prospective observational study on adults with T2DM who were interested and agreed to adhere to a structured fasting protocol. The 16: 8 time-restricted eating protocol was applied with continuous compliance for 12 weeks. We monitored HbA1c, fasting and post-meal glucose, lipid profile, body mass index (BMI) and insulin/oral agent dose as the parameters of interest. Measurements were taken at baseline and at the end of 12 weeks. All patients continued on their pre-study medications throughout the study period, that is, IF was added to their usual diabetes management. No changes to prescribed therapies were allowed during the study period.

Results: Sixty patients were recruited and 54 patients completed the study. At week 12, mean HbA1c decreased from 8.4% to 7.7% ($p<0.01$), mean fasting glucose improved from 162 mg/dL to 138 mg/dL ($p<0.01$). Mean weight on the scale was reduced by 2.8 kg ($p<0.05$). HDL cholesterol also increased slightly, although the change was not significant. It is interesting to note that many patients reduced their insulin dose (self-adjusted) without any deterioration of blood glucose control; this may have been facilitated by the fasting regimen. The ability to reduce insulin without increase in hypoglycaemia could be a unique advantage of IF. No hypoglycaemic events of severity were observed. No adverse events were recorded in the study.

Conclusion: Our study supports the short-term metabolic benefits of intermittent fasting in patients with T2DM, particularly in improving glycaemic control and promoting modest weight loss. While IF may not replace pharmacotherapy, it appears to be a safe, feasible, and culturally acceptable adjunct. Longer-duration studies are warranted to understand its sustained effects and long-term safety.

Keywords: Intermittent fasting, Type 2 diabetes mellitus, Glycaemic control, Time-restricted eating, HbA1c, Metabolic syndrome.

Introduction

Type 2 diabetes mellitus (T2DM) remains a major health and economic burden globally and especially in developing economies such as India where prevalence is on the rise. Conventional methods of glycaemic control - including pharmacotherapy and low-calorie diets - have generally been constrained by adherence and long-term results, especially in cases where patients experience difficulty in complex diets or unrelaxing medication schedules [1].

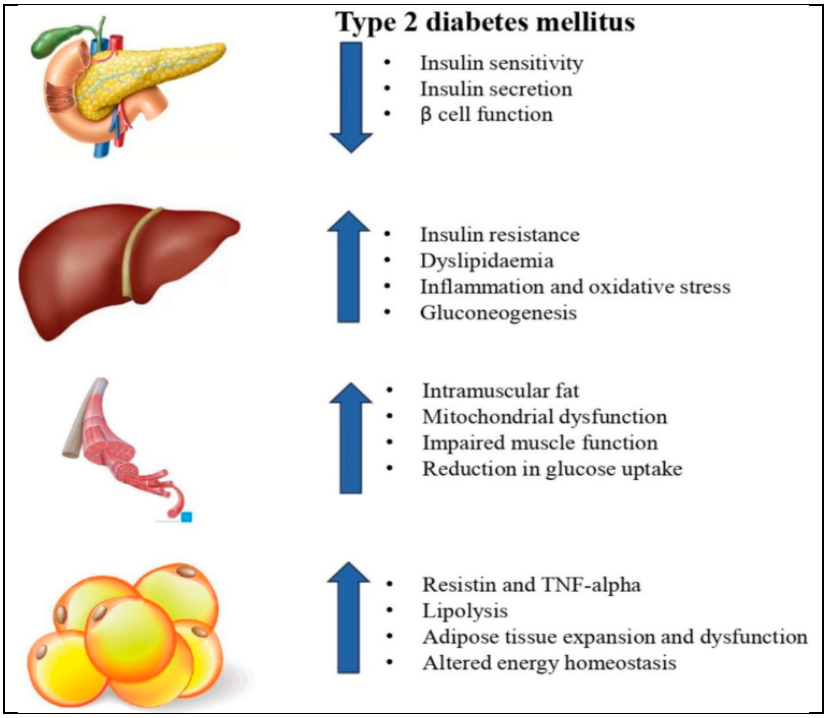

Figure 1: Primary organs and molecules whose modifications contribute to the progression of type 2 diabetes mellitus

Intermittent fasting (IF) has become one of the most promising and flexible lifestyle strategies, which can potentially provide both metabolic and behavioural advantages in the management of T2DM in recent years. In comparison to continuous calorie restriction, IF comprises alternating between eating and fasting, which can contribute to better insulin sensitivity, weight loss, lipid metabolism, and glycaemic regulation, without limiting caloric intake, as the caloric regulation is not mandatory [2].

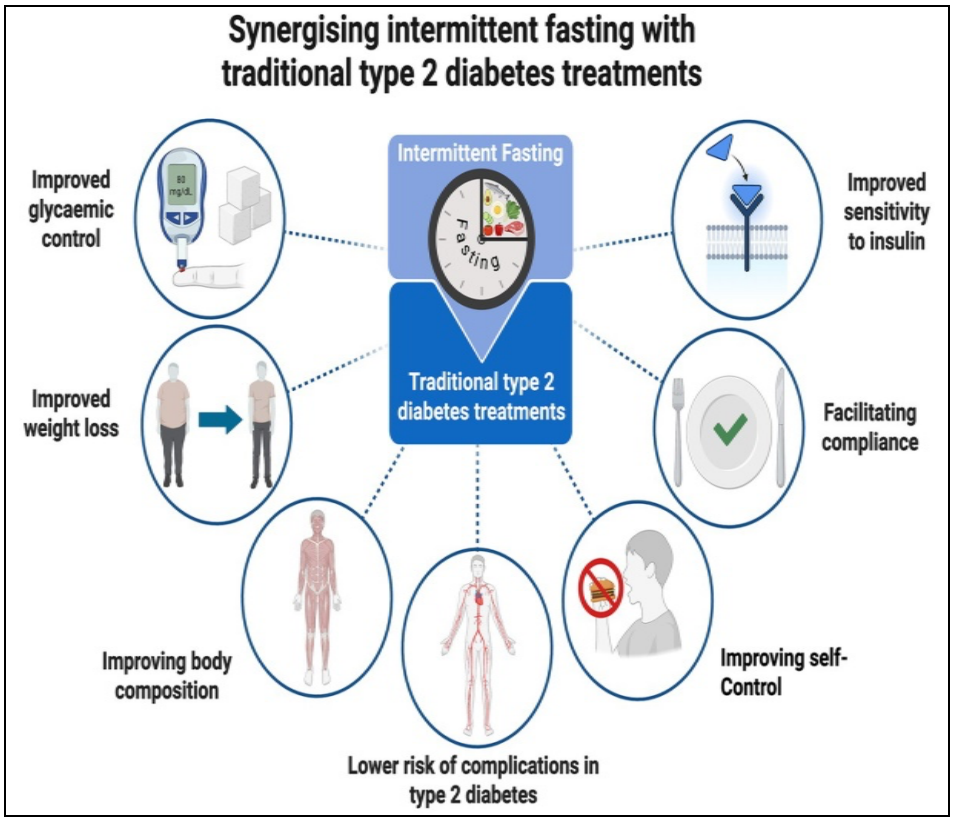

Figure 2: Synergizing intermittent fasting with traditional type 2 diabetes treatments

Some of the patterns of IF have been examined such as time-restricted eating (TRE), alternate-day fasting, and the 5:2 diet. The most popular of these is 16:8 TRE, in which individuals do not eat during 16 hours of the day and consume food within an 8-hour timeframe per day, because it is easy and culturally flexible [3].

A meta-analysis study by Liu et al. (2023) with 10 randomized controlled trials has shown that IF significantly lowered HbA1c, fasting glucose and body weight in the short-term. Nevertheless, the advantages tended to decrease after the fasting procedure was abandoned [4].

A second large randomized trial by Guo et al. (2024) found that an intermittent fasting diet with a 5:2 ratio with meal replacements was superior to metformin or empagliflozin and decreased HbA1c and weight loss after 16 weeks [5].

Moreover, two-day weekly fasting (TWF) was one of the most effective regimens in a network meta-analysis by Xiaoyu et al. in 2024, especially at enhancing fasting glucose and insulin resistance [6]. Pragmatic evidence on Borgundvaag et al. also indicates that IF may result in the modest loss of weight and decrease of glycaemic variation among patients with T2DM, but long-term sustainability and safety are under active research areas [7].

Although there is a growing global attention, Indian data on the metabolic effects of intermittent fasting in T2DM are limited. Since cultures, dietary and genetic variations are diverse, the region-specific evidence is necessary to confirm IF as effective adjunct therapy. The short-term effects of 16:8 time-restricted diet on the metabolism in T2DM adults, in terms of glycaemic indices, lipid profile, weight, and safety were the objectives of our potential observational study.

Materials and Methods

Study Design and Setting: Our study was a prospective observational study conducted over a period of 12 weeks in the outpatient department of Internal Medicine at a tertiary care center. The primary objective was to assess the short-term metabolic effects of intermittent fasting (IF) in patients with type 2 diabetes mellitus (T2DM) who voluntarily adopted a 16:8 time-restricted eating regimen. The study protocol was reviewed and approved by the Institutional Ethics Committee, and informed written consent was obtained from all participants prior to enrolment.

Eligibility Criteria: A total of 60 adult patients aged between 35 and 65 years with a confirmed diagnosis of T2DM for at least one year were recruited. Patients were required to be on stable doses of oral antidiabetic drugs or insulin therapy for the past three months prior to study initiation. Individuals with type 1 diabetes, pregnant or lactating women, those with advanced renal or hepatic dysfunction, or patients on medications known to significantly alter metabolism (such as steroids or SGLT2 inhibitors) were excluded. Additional exclusion criteria included recent hospitalization, acute illness within the past three months, or any diagnosed eating disorder that could interfere with adherence to the fasting protocol.

Fasting Intervention Protocol: Participants voluntarily followed a 16:8 time-restricted eating pattern, wherein all food intake occurred within an 8-hour window (typically from 10:00 AM to 6:00 PM), followed by a fasting period of 16 hours. During the fasting phase, only water, plain herbal teas, and black coffee without sugar were permitted. The participants were advised to maintain their regular dietary choices within the feeding window without specific caloric restrictions. No pharmacological interventions were introduced or altered during the study, unless medically necessary.

Data Collection and Metabolic Parameters: Baseline data were collected prior to initiation of the fasting regimen and were repeated at the end of 12 weeks. The parameters recorded included glycated haemoglobin (HbA1c), fasting plasma glucose (FPG), postprandial blood glucose (PPBG), and lipid profile (total cholesterol, LDL-C, HDL-C, and triglycerides). Body weight and body mass index (BMI) were also measured using standard techniques. Any changes in antidiabetic medication usage, particularly in insulin dosage or oral hypoglycaemic agents, were documented. Participants were followed up regularly through clinic visits and telephonic consultations to monitor adherence and to screen for any adverse effects such as hypoglycaemic episodes, dizziness, or intolerance to fasting.

Statistical Analysis: All data were compiled using Microsoft Excel and analyzed using SPSS version 25. Continuous variables were expressed as mean ± standard deviation (SD). Pre- and post-intervention values were compared using paired Student's t-tests. A *p*-value of less than 0.05 was considered statistically significant for all comparisons.

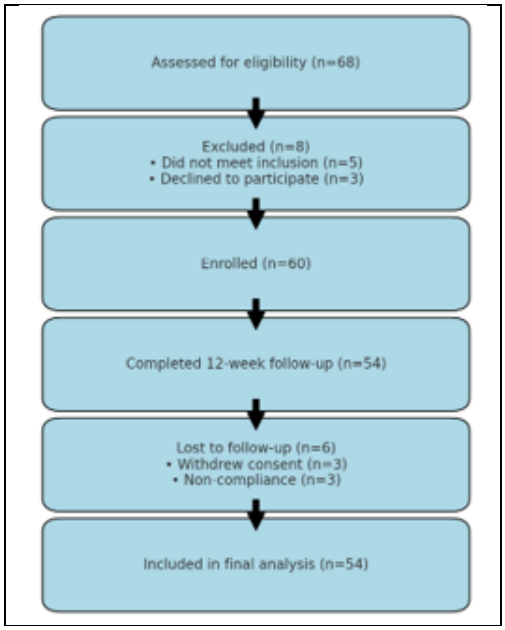

Figure 3: Study flowchart

Results

Among 68 eligible patients who were screened, 60 had been recruited into the study and signed informed consent forms that satisfied the inclusion criteria of the study. These patients initiated the 12 weeks intermittent fasting. At the end of the study period, 54 patients who underwent the complete follow-up period were included in final analysis. Six lost to follow up, three dropped out voluntarily with personal reasons, and the rest could not stick to the 16: 8 fasting window even though they were motivated at the start. Notably, all of the subjects did not drop out because of adverse effects and complications associated with the dietary intervention itself and there were no reports of protocol violations and drug abuse. The baseline features of the sample population gave a clear description of the normal middle-aged adults with type 2 diabetes in a city in India. The mean age of the subjects was slightly over 52 years, with a slight male predominance; the majority had been living with diabetes for at least seven years. Their glycaemic control was not optimal at the start since the baseline mean HbA1c of 8.4% is far beyond the ADA-recommended value of less than 7. A portion of the cohort was overweight or slightly obese with the mean body mass index was 28.4 kg/m. Approximately 40% of the respondents were also on insulin treatment besides oral hypoglycaemic medications indicating some patients in the sample were at both ends of the glycaemic control difficulty curve.

After 12 weeks of high adherence to the intermittent fasting program, the changes in a number of the metabolic parameters were meaningful and statistically significant. Among the most significant findings was the decrease in glycated haemoglobin (HbA1c) that fell to 7.7 on average when it used to be 8.4. 0.7 percent change in HbA1c is clinically significant and usually comparable to the effect of introduction of a new oral antidiabetic agent or dose adjustment of insulin. The decrease in HbA1c was specifically also interesting since it was achieved without any alterations in the pharmacological management of the subjects, the participants received only the change in the timing of meals, but not their content or volume.

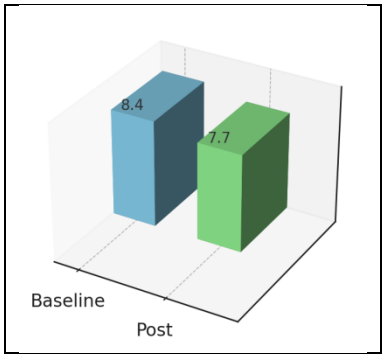

Figure 4: change in HbA1c (%) before and after 12 weeks of intermittent fasting

In parallel, both fasting and postprandial glucose levels showed favourable changes. The mean fasting blood glucose reduced from 162 mg/dL at baseline to 138 mg/dL by the end of 12 weeks.

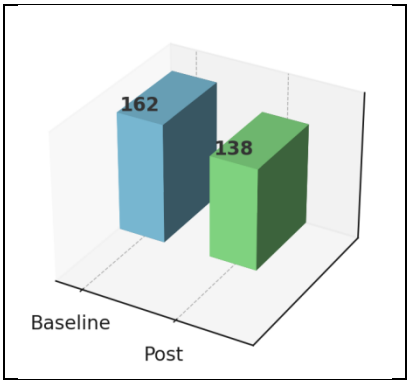

Figure 5: Change in fasting plasma glucose before and after intermittent fasting

Similarly, postprandial glucose levels dropped from an average of 218 mg/dL to 186 mg/dL. These improvements can be partly explained by enhanced insulin sensitivity during fasting windows, reduced post-meal glucose excursions, and possibly improved beta-cell responsiveness, as suggested in earlier studies on intermittent fasting. Participants reported better appetite regulation and a sense of control over their eating patterns, which may have contributed to improved glycaemic trends even during the feeding windows.

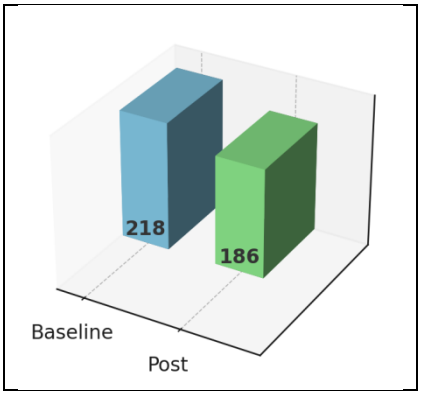

Figure 6: Change in postprandial glucose levels before and after 12 weeks of intermittent fasting

In terms of anthropometric outcomes, intermittent fasting also resulted in a modest but consistent weight loss. The average reduction in body weight was approximately 2.8 kg over 12 weeks, and this corresponded to a drop in BMI by nearly 1.2 kg/m². Although the intervention did not impose any calorie restrictions, most participants naturally reported consuming slightly fewer calories, especially during the initial weeks of adaptation to the shorter eating window. More importantly, the weight loss observed was gradual, and no participant developed signs of undernutrition or muscle wasting during the study.

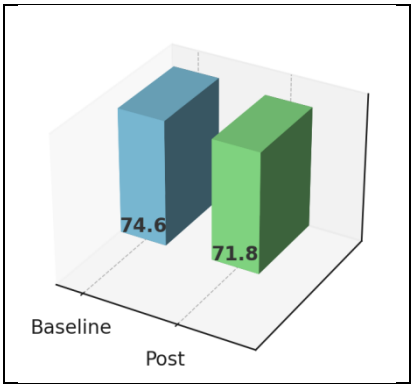

Figure 7: Reduction in body weight following 12 weeks of intermittent fasting.

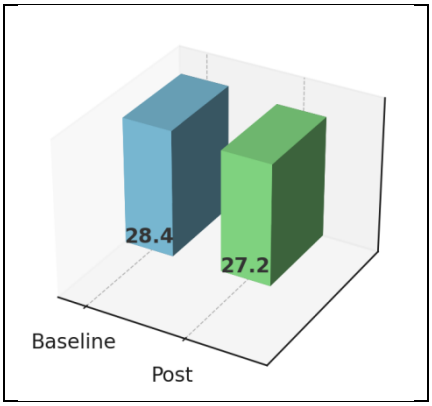

Figure 8: Decrease in body mass index (BMI) after intermittent fasting intervention

Lipid parameters also responded favorably to the intervention, though to a lesser extent compared to the glycaemic indices. There was a statistically significant decline in low-density lipoprotein (LDL) cholesterol levels, from a mean of 112 mg/dL to 104 mg/dL. High-density lipoprotein (HDL) cholesterol, which is considered protective, increased from an average of 42 mg/dL to 45 mg/dL. Triglyceride levels showed a decreasing trend as well, falling from 168 mg/dL to 154 mg/dL, although this change did not reach statistical significance. These trends suggest that intermittent fasting may have modest lipid-lowering effects, possibly due to increased mobilization of fat stores during prolonged fasting intervals and improved hepatic lipid metabolism.

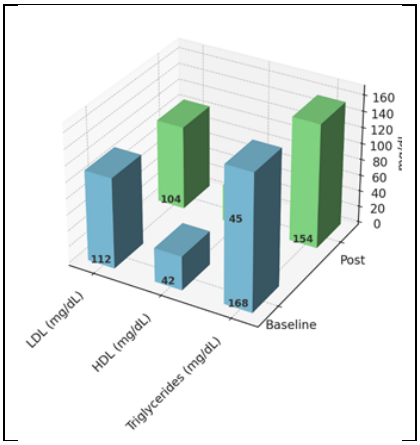

Figure 9: Changes in LDL, HDL, and triglyceride levels before and after intermittent fasting

One of the most encouraging outcomes was the change in insulin requirements among a subset of patients. Eleven out of the 54 patients who completed the study were able to reduce their insulin dosage under physician supervision, and none experienced a worsening of blood sugar control. This observation, though not a primary endpoint, indicates that intermittent fasting may reduce the body's dependency on exogenous insulin by improving endogenous insulin activity. This is consistent with earlier theories that fasting can restore insulin sensitivity at the cellular level. The safety profile of the intervention was also reassuring. There were no episodes of severe hypoglycaemia, hospitalizations, or serious adverse events reported during the entire study period. A few participants did experience mild symptoms such as fatigue or irritability, particularly during the first 1–2 weeks of starting the fasting regimen. However, these symptoms were transient and resolved without requiring discontinuation. Most patients adapted well to the schedule within the first month and reported that the intervention was easier to sustain than traditional calorie-counting diets.Taken together, these results suggest that a 16:8 intermittent fasting regimen practiced consistently over 12 weeks can lead to improvements in glycaemic control, modest weight loss, favorable changes in lipid profile, and even a reduction in insulin requirement — all without significant side effects or disruptions to routine medications. The findings are in line with other clinical trials and systematic reviews that have highlighted the metabolic benefits of time-restricted eating in patients with type 2 diabetes.

Discussion

Our observational research offers additional support to the idea that intermittent fasting (IF), especially 16:8 time-restricted dietary habit, is

linked to significant changes in metabolic measures among patients with type 2 diabetes mellitus (T2DM). In 12 weeks, we experienced clinically significant glycaemic index improvement, modest weight loss, and positive lipid profile change in the absence of pharmacological escalation and extreme caloric limitation.

The 0.7% reduction in HbA1c was a key finding and can be compared to the glycaemic outcome of the second-line oral hypoglycaemic agent. This coincides with the results of Liu et al., who in a meta-analysis of randomized controlled trials showed that intermittent fasting does have the potential to positively modify HbA1c levels, particularly when done on a regular basis over a duration of greater than 8 weeks in patients with T2DM 4. Equivalent findings were provided by Guo et al., who stated that higher HbA1c reduction in the patient after the structured 5:2 intermittent fasting meal replacement study was observed in comparison with empagliflozin or metformin [5].

Fasting blood glucose and postprandial glucose levels also improved significantly in our study, with an average fasting glucose reducing to 138 mg/dl and postprandial glucose reducing to 186 mg/dl. These results align with meta-analysis data demonstrated by Wang et al. who found that different intermittent fasting regimens such as time-restrained feeding and alternate-day fasting were efficient in the reduction of fasting glucose and body weight among patients with T2DM [6].

We saw a small change of 2.8 kg weight loss in our patients and a decrease in BMI. Although we did not impose definite caloric goals on our patients, the time-restricted diet presumably enabled them to reduce calories spontaneously and enhance metabolic plasticity. This is in line with the results of Borgundvaag et al., who through their pooled analysis of seven randomized controlled trials found that intermittent fasting not only results in weight loss but also in insulin sensitivity among patients with diabetes [7]. The other interesting observation with regard to our results was the positive lipid profile change. There was a reduction in the levels of LDL cholesterol, a slight increase in the HDL levels and moderate improvement in triglyceride levels. The latter trends were also noted in prior IF research, with the systematic reviews by Liu et al. and Wang et al. suggesting that IF can help reduce cardiovascular risk, albeit significantly and in longer periods [4,6].

Notably, no incidences of extreme hypoglycaemia or adverse experiences were seen within the 12 weeks of the research, which implies a favorable tolerability and safety profile of intermittent fasting in steady T2DM individuals. These safety results are consistent with those of Borgundvaag et al. who emphasize low rates of hypoglycaemia and adverse events in their report of IF interventions in diabetic patients [7].

The net outcome in glycaemic control, anthropometry and lipid indices are indicative of the possibility of intermittent fasting working through a variety of mechanisms - such as enhancement of insulin sensitivity, decreased hepatic glucose secretion and modulated circadian metabolism. Such advantages, in the long-term, can be translated into decreased medication dependence and decreased risk of chronic complications among the patients of T2DM.

Limitations

Despite the promising results, our study has limitations. The relatively short duration (12 weeks), modest sample size, and lack of a non-fasting control group limit the generalizability of our findings. Dietary intake was not strictly monitored beyond fasting compliance, and long-term adherence to intermittent fasting was not assessed. Future randomized controlled studies with longer follow-up periods are warranted to evaluate sustained effects, medication adjustments, and quality-of-life outcomes.

Conclusion

The results of our prospective observational study suggest that intermittent fasting, specifically the 16:8 time-restricted eating regimen, offers a safe, practical, and effective non-pharmacologic intervention for improving glycaemic control, reducing body weight, and favourably altering lipid profile in patients with type 2 diabetes mellitus (T2DM). Over a 12-week period, patients demonstrated significant reductions in HbA1c, fasting and postprandial glucose levels, body mass index, and low-density lipoprotein (LDL) cholesterol, without an increase in adverse effects or hypoglycaemic episodes.

These findings align with a growing body of evidence that supports the metabolic benefits of intermittent fasting in individuals with T2DM. The favourable outcomes observed in our study highlight its potential as an adjunctive lifestyle strategy that can complement existing pharmacologic therapies, improve insulin sensitivity, and potentially reduce medication burden. Although larger randomized controlled trials with longer follow-up durations are needed, our results provide encouraging support for incorporating structured intermittent fasting protocols under medical supervision into routine diabetes care.

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Author Contributions

Dr. Sahil Sangwan: Conceptualization, Study Design, Data Collection, Statistical Analysis, Writing – Original Draft.

Dr. Nishant Rawtani: Supervision, Critical Review, Editing, Patient Follow-up, Data Monitoring, Literature Review

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