

Effect of intermittent fasting on diabetic patients-A narrative review

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ABSTRACT

Managing diabetes requires careful food choices, especially for those with limited access to nutritious options. Intermittent fasting (IF) has emerged as a promising strategy for improving outcomes in both type 1 (T1DM) and type 2 diabetes mellitus (T2DM) by stabilizing blood glucose levels and aiding in weight management. This review explores various methods of IF, including the 16/8 method, 5:2 diet, Eat-Stop-Eat, and others, highlighting their potential benefits such as weight loss, improved insulin sensitivity, and glucose tolerance. Although IF shows promise, particularly in T2DM, it poses risks like hypoglycemia and dehydration, particularly in T1DM. Safe practices include consulting healthcare providers, monitoring glucose and ketone levels, and adjusting medications. This review highlights the need for individualized approaches to IF to optimize diabetes management and mitigate risks.

Keywords: Caloric restriction, dietary management, intermittent fasting, Obesity & diabetes

Introduction

Managing diabetes requires careful attention to food choices that help stabilize blood sugar and insulin levels. This can be especially difficult for people in areas with limited access to nutritious food.^[1] In addition to blood sugar control, maintaining a healthy weight through regular exercise and a balanced diet is vital. Excess weight or obesity increases the risk of developing diabetes or worsening the condition in those already diagnosed. As a result, researchers, healthcare professionals, and the diabetes community have increasingly focused on eating patterns, such as intermittent fasting (IF), to improve outcomes.^[2] Interestingly, individuals with type 1 diabetes mellitus (T1DM) often face challenges similar

to those with type 2 diabetes mellitus (T2DM), such as weight gain and decreased insulin sensitivity, a phenomenon known as “double diabetes.” Given the rising rates of overweight and obesity in people with T1DM, there is an urgent need to explore nutritional interventions for this population.^[3] For individuals with T2DM, weight loss is a key component of treatment and is often addressed through personalized therapeutic strategies. Dietary recommendations emphasize healthy food choices and eating behaviors that align with individual preferences to foster long-term, sustainable habits. Among these strategies, creating an energy deficit through intermittent fasting has gained attention as a viable option for long-term weight management in T2DM.^[4]

During intermittent fasting, the body uses stored fat for energy potentially leading to weight loss and other health benefits. The goal of IF approaches is to lower the calorie intake, which is highly beneficial for diabetic patient who aims to shed weight or sustain weight loss. Recent studies indicate that intermittent fasting can improve insulin sensitivity and glucose tolerance,

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particularly in individuals who are overweight or at high risk for T2DM. This growing body of evidence highlights the potential of intermittent fasting as a valuable tool in diabetes management, emphasizing the importance of eating patterns in improving overall metabolic health.^[5] However, these benefits must be weighed against the risks, particularly for individuals taking medications that affect blood sugar. Close tracking of glucose levels and adjusting insulin doses carefully are vital during fasting, particularly for individuals with type 1 diabetes, who face an increased risk of hypoglycemia and diabetic ketoacidosis.

This paper aligns closely with the journal's focus on primary care, family medicine, and patient-centered research by addressing a prevalent and growing health concern—diabetes management—in the context of everyday clinical practice. Intermittent fasting, as a dietary intervention, represents a practical and cost-effective strategy that primary care providers and family physicians can integrate into individualized care plans. By reviewing evidence on its effects on weight, blood glucose levels, and insulin sensitivity, this article provides actionable insights that support holistic, patient-centered approaches.

Various Methods of Intermittent Fasting

Intermittent fasting is an eating pattern that alternates between periods of fasting and eating. Rather than focusing on what foods to eat, it emphasizes when to eat. Intermittent fasting encompasses a variety of methods, each with distinct eating and fasting patterns [Table 1].

The 16/8 method is one of the most popular, involving 16 hours of fasting followed by an 8-hour window for eating, typically skipping breakfast.^[6,7]

Another approach is periodic fasting, and this type of fasting involves no or minimal calorie intake for 24-hour periods. Examples are the 5:2 diet and Eat–Stop–Eat. The 5:2 diet, where normal eating occurs five days a week, and calorie intake are restricted to around 500–600 calories on the other two days.^[8] The Eat–Stop–Eat method involves fasting for a full 24 hours

once or twice a week, while the alternate-day fasting method alternates between a day of regular eating and a day of fasting or consuming very few calories.^[9]

The Warrior Diet follows a 20-hour fasting period with a 4-hour eating window, focusing on consuming small amounts of raw fruits and vegetables during the day and one large meal at night.^[10] Spontaneous meal skipping is a more flexible approach, where individuals skip meals when they are not hungry, without following a strict schedule.^[11]

Weekly one-day fasting involves a water-only regimen practiced once per week for 24 hours, where no food is consumed. The fast-mimicking diet, followed once per month for 120 hours, allows small amounts of macronutrients, providing a low-calorie ketogenic effect while mimicking the benefits of fasting without full food deprivation. In a ten-day juice fast, which is done with irregular frequency, fruit juices or broths are consumed for 240 hours, avoiding solid foods but providing some nutrients during the fasting period.^[12]

Each of these IF methods offers flexibility in adapting to individual lifestyles and health goals, with varying degrees of intensity and fasting duration.

Physiology Behind Intermittent Fasting

The physiology of intermittent fasting involves various metabolic adaptations that occur as the body alternates between periods of eating and fasting. During fasting, the body depletes its glucose and glycogen stores and begins to utilize stored fat for energy, leading to increased fat burning.^[13] As this process continues, the liver converts fatty acids into ketone bodies, which provide an alternative energy source for the brain and other organs, helping to preserve muscle tissue by minimizing the need for protein breakdown. Fasting also improves insulin sensitivity by lowering insulin levels, allowing cells to more efficiently regulate blood glucose and reduce insulin resistance, which benefits overall metabolic health. Additionally, intermittent fasting activates

Table 1: Different protocols for intermittent fasting

Method	Duration	Frequency	Calories allowed	Additional considerations
16/8 method	16 hours fasting	Daily	No calories during fasting	Eating within an 8-hour window, often skipping breakfast.
5:2 diet	24 hours fasting	Twice a week	500-600 calories	Regular eating on 5 days, reduced calorie intake on 2 non-consecutive days.
Eat-stop-eat	24 hours fasting	1-2 times a week	No calories	Fasting for a full 24 hours once or twice a week.
Alternate-day fasting	24 hours fasting	Every other day	Very low calories	Alternates between regular eating and fasting days with minimal calorie intake.
Warrior diet	20 hours fasting	Daily	Small snacks allowed	Eating one large meal at night, small amounts of fruits/veggies allowed during the day.
Spontaneous meal skipping	Varies	Irregular	No strict limit	Skipping meals when not hungry, without following a strict schedule.
Weekly one-day fasting	24 hours fasting	Once a week	No calories	Water-only fasting for a full day once per week.
Fast-mimicking diet	120 hours fasting	Once a month	Low-calorie, ketogenic	Allows small amounts of macronutrients, mimicking the benefits of fasting.
Ten-day juice fast	240 hours fasting	Irregular	Only juices or broths	Fruit juices or broths are consumed during the fasting period, no solid food.

autophagy, a cellular process that removes damaged components and promotes repair and regeneration, contributing to improved longevity and a reduced risk of chronic diseases. Hormonal changes during fasting, such as the release of norepinephrine and increased growth hormone levels, further enhance fat burning, metabolic rate, and muscle preservation. Together, these physiological responses optimize energy use, enhance metabolic flexibility, and support overall health and longevity.^[14]

Effect of Intermittent Fasting on Weight, Blood Glucose, and Insulin Sensitivity on Diabetic Patient

The lifetime risk of developing diabetes in men over 18 rises dramatically from 7% to 70% as BMI increases from below 18.5 kg/m² to over 35 kg/m². Similarly, in women, the risk jumps from 12% to 74% with the same BMI range. Addressing obesity is fundamental to preventing and managing type 2 diabetes (T2DM), with weight loss significantly reducing the incidence of diabetes in high-risk populations.^[15]

Studies showed that intermittent fasting aids weight loss, supporting type 2 diabetes remission by reducing calorie intake during restricted eating hours.^[16] A clinical trial of people with obesity and type 2 diabetes revealed that after six months, participants in the intermittent fasting group experienced an average weight loss of 3.6% compared to the control group (calorie restriction). Conversely, those in the calorie restriction group did not show significant weight loss. Both groups, however, demonstrated similar improvements in blood glucose levels and reductions in waist circumference. Neither group experienced serious side effects, including episodes outside of a safe blood glucose range. Participants in the fasting group also reported finding their diet easier to stick to than those on calorie restriction.

A clinical trial found that time-restricted eating led to a 3.6% weight loss over six months in people with obesity and type 2 diabetes, compared to no significant weight loss with calorie restriction. Time-restricted eating was reported as easier to follow.^[7]

The review of eight trials on modified intermittent fasting in overweight or obese adults found that 75% of the studies reported significant weight loss, ranging from 3.2% to 8.0%. Two of five studies observed reductions in fasting insulin, though none reported decreases in fasting glucose. Additionally, three of eight studies showed improvements in lipid profiles, and two of five studies reported reduced inflammatory markers. The fasting regimens also resulted in mood improvements, such as decreased tension, anger, and fatigue, along with increased self-confidence and positive mood. Negative side effects were minimal.^[9]

A randomized controlled trial compared intermittent fasting (IF) 16:8, IF 14:10, and a control diet in 99 obese diabetic participants over 3 months. The percentage weight change was −4.02% in IF

16:8, −3.15% in IF 14:10, and −0.55% in the control group. Both IF groups showed significantly greater weight loss, improved fasting blood sugar, HbA1c, and lipid profiles compared to the control group, with IF 16:8 showing superior results to IF 14:10.^[6]

A randomized clinical trial involving 405 overweight or obese Chinese adults with early type 2 diabetes found that a 5:2 meal replacement (MR) plan led to a significantly greater reduction in HbA1c levels (−1.9%) compared to metformin (−1.6%) and empagliflozin (−1.5%) after 16 weeks. Additionally, the 5:2 MR group experienced greater weight loss (−9.7 kg) than the metformin (−5.5 kg) and empagliflozin (−5.8 kg) groups, indicating its potential as a short-term intervention for early diabetes management.^[8] Intermittent fasting (IF) in 27 trials led to weight loss ranging from 0.8% to 13% of baseline weight without serious adverse effects. The results were comparable to those from calorie restriction diets. Among five studies involving type 2 diabetes patients, IF improved glycemic control.^[17]

A randomized controlled trial meta-analysis compared four intermittent fasting regimens for type 2 diabetes. Based on 13 studies involving 867 patients, all fasting regimens—twice-per-week fasting, fasting-mimicking diet, time-restricted eating, and periodic fasting—outperformed conventional diets. The surface under the cumulative ranking curve analysis ranked twice-per-week fasting as most effective for reducing fasting blood glucose, glycated hemoglobin, and insulin resistance.^[18]

Insulin is the key hormone responsible for regulating blood glucose levels. For individuals with diabetes, maintaining stable blood sugar is crucial and is typically assessed through time in range, A1c, and fasting glucose levels. A 2021 review demonstrated that intermittent fasting (IF) led to a notable decrease in fasting glucose, averaging a reduction of 4 mg/dL. Additionally, IF contributed to lower A1c levels, weight loss, and increased adiponectin, a hormone that enhances insulin sensitivity.^[19] A comprehensive 2022 review also highlighted improved insulin resistance as a key benefit of IF.^[20] A study involving individuals with type 2 diabetes reported significant reductions in A1c levels and body weight after 12 weeks of IF. Similarly, a 2024 review on time-restricted eating found that fasting led to lower A1c in people with type 2 diabetes, while the improvements in glycemic control are likely linked to weight loss.

A 2021 randomized controlled trial by Che *et al.*^[21] demonstrated that time-restricted eating (TRE) can enhance insulin sensitivity in patients with diabetes or prediabetes. Sixty participants followed a 10-hour feeding schedule (8:00 to 18:00) and a 14-hour fasting period for 12 weeks. The intervention reduced fasting glucose levels by 15% and hemoglobin A1c (HbA1c) by 18%, nearly twice the impact of typical diabetes medication. This suggests that TRE is a promising complementary therapy for improving health in individuals with diabetes or prediabetes.^[22]

The systematic review on patient with impaired glucose and lipid metabolism analysis revealed that intermittent fasting

significantly improved several clinical indicators: fasting blood glucose decreased by 0.15 mmol/L, glycosylated hemoglobin by 0.08, insulin levels by 13.25 uUI, and HOMA-IR by 0.31. Additionally, body measurements improved with BMI dropping by 0.8 kg/m², body weight reducing by 1.87 kg, and waist circumference by 2.08 cm. In terms of lipid metabolism, total cholesterol fell by 0.32 mmol/L, low-density lipoprotein by 0.22 mmol/L, and triglycerides by 0.04 mmol/L. These findings suggest that intermittent fasting can be an effective adjunctive treatment for improving glucose and lipid profiles and insulin sensitivity, potentially aiding in the prevention and management of chronic diseases.^[23]

Drawback of Intermittent Fasting on Diabetic Patient

The disadvantages and side effects of IF can vary among individuals. A 2024 review explained side effects, which may include headaches, lethargy, constipation, dehydration, hypoglycemia, sleep disturbances, disordered eating, dizziness, and irritability.^[24]

IF is not recommended for type one diabetes because of the risk of profound hypoglycemia. While many individuals with type 1 diabetes participate in fasting, there are risks such as diabetic ketoacidosis (DKA) and hypoglycemia. To minimize these risks, glucose and ketone levels must be closely monitored, and medication adjustments are necessary. Insulin doses should be reduced cautiously during fasting, and regular testing of ketones is essential to prevent DKA.^[13]

As per 2024 the review article, although IF may improve the body's response to insulin, it can be challenging to maintain stable blood sugar levels and adjust medications to prevent low blood sugar. As a result, IF can pose challenges for people with diabetes in managing their condition. However, some studies have shown benefits for individuals with type 2 diabetes. Consulting a healthcare professional is essential before starting IF in this case.^[22] A review highlights that intermittent fasting (IF) poses significant risks for individuals with diabetes, especially those on antidiabetic medications like insulin and sulfonylureas, which can cause hypoglycemia.^[25] A RCT highlights that while other antidiabetic drugs rarely cause low blood sugar, the risk is not completely absent. IF can lead to hypoglycemia if blood sugar drops too low due to reduced food intake, with symptoms including shakiness, confusion, and dizziness.^[26]

Conversely, hyperglycemia can occur if excessive eating follows fasting, potentially leading to complications such as neuropathy and heart disease. Consulting a diabetes care team is crucial before starting IF to ensure it is safe and properly managed.

Long-term intermittent fasting can lead to various health risks if not properly managed. Protein malnutrition may occur if adequate protein intake is not maintained, while vitamin and mineral deficiencies might require supplementation based on fasting frequency and food choices. Dehydration is a significant

concern, as lack of fluid intake during fasting can lead to severe conditions such as stroke. Energy deficiency may result in symptoms like dizziness, nausea, and weakness. People with chronic diseases, such as diabetes, heart conditions, or cancer, face increased risks of serious adverse events like myocardial infarction or stroke during fasting. Specific populations, including pregnant and lactating women, young children, older frail adults, and immunocompromised individuals, are particularly vulnerable. Additionally, those with eating disorders, dementia, or traumatic brain injury may experience exacerbated health issues or require careful consideration before engaging in fasting.^[12]

Safe Practices for Intermittent Fasting in Diabetic Patients

A 2023 narrative review suggests that, for a healthy fasting experience, diabetes patients should consult their healthcare provider to tailor the fasting plan to individual needs and health conditions. Regular monitoring of blood glucose levels is essential to detect any significant changes or potential hypoglycemia or hyperglycemia. Adjustments to insulin or other diabetes medications may be necessary to prevent hypoglycemia during fasting periods. Staying hydrated by drinking plenty of water throughout the fasting period is crucial to avoid dehydration, which can impact blood glucose levels and overall health.^[2] A 2019 review article emphasizes that, for those with type 1 diabetes, regular testing of ketone levels is important to prevent diabetic ketoacidosis (DKA).^[12] A 2024 review article suggests that focusing on nutrient-dense foods with balanced meals containing adequate protein, healthy fats, and fiber helps maintain stable glucose levels and provides sustained energy. Breaking the fast gradually with small, easily digestible meals can prevent spikes in blood glucose levels. Incorporating regular physical activity into the routine, while adjusting intensity based on the fasting schedule and personal well-being, is beneficial.^[22] Understanding how fasting affects the body and diabetes management enables informed decisions and adjustments. It is also important to be attentive to symptoms of low or high blood sugar and adjust fasting or treatment plans as needed.^[25] Following these guidelines can effectively manage diabetes while fasting and reduce the risk of complications.

Conclusion

Intermittent fasting (IF) presents a compelling approach for diabetes management, demonstrating benefits in weight loss, insulin sensitivity, and glucose control. Evidence indicates that various IF methods, such as the 16/8 method and the 5:2 diet, can effectively reduce body weight and improve metabolic markers in individuals with type 2 diabetes. However, the application of IF in type 1 diabetes remains challenging due to risks like hypoglycemia and diabetic ketoacidosis. Recommendations for individuals considering IF include consulting healthcare professionals to tailor the fasting regimen, closely monitoring blood glucose and ketone levels, and ensuring adequate hydration and nutrient intake. Future research should focus on optimizing IF protocols for diverse diabetic populations and addressing long-term safety

and efficacy. Adopting these practices can enhance diabetes management and potentially improve overall health outcomes.

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RS and SKM contributed to conceptualization of article, finding resources, and writing—original draft preparation. RS, VB, and SKM were involved in writing—review and editing. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest

The author(s) declare(s) that there is no conflict of interest.

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