

Intermittent Fasting: A Promising Tool for Controlling Diabetes

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ABSTRACT

Intermittent fasting has gained attention as a potential strategy for managing diabetes mellitus, a common metabolic condition characterized by low insulin sensitivity or insufficient insulin synthesis. This article offers a thorough analysis of the benefits, dangers, and consequences of intermittent fasting for the control of diabetes. It discusses the metabolic impacts of intermittent fasting on insulin levels, insulin resistance, and glucose control, drawing insights from both animal and human studies. The article also highlights the importance of careful consideration and medical supervision, especially for individuals with type-1 or type-2 diabetes, due to the potential risk of hypoglycemia and other adverse effects. The limited yet promising evidence suggests that using intermittent fasting can help us lose weight. Reduced insulin requirements, and improved glycemic control. However, caution is advised, and personalized adjustments to diabetes medications and monitoring of blood glucose levels are essential to ensure the safety and efficacy of intermittent fasting as part of diabetes management.

Keywords: Diabetes, Intermittent fasting, Consequences, Investigation, Implementation, Medications, Hypoglycemia, Insulin, Medical Intervention.

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INTRODUCTION

Over time, type 2 diabetes has become more common. According to estimates by Baumeier *et al.* (2015), 592 million individuals will have this kind of diabetes by the year 2035.¹ A person with type-2 diabetes has a metabolic disorder where their body produces not utilize insulin correctly, which entails that the body is resistant to it or that the pancreas is no longer producing enough insulin. Hyperglycemia is the outcome of incorrect insulin use. Increased blood glucose levels. The body can suffer significant consequences from hyperglycemia.² Such as increased appetite and excessive thirst, weariness, impaired eyesight, slow-healing wounds, black urine, if left untreated, skin lesions might lead to repeated infections (Mayo Clinic Staff 2020). Diabetes has been associated with more severe problems like kidney failure, neuropathy, and cardiovascular disease (Arnason *et al.* 2017).³ Environmental and genetic variables seem to play a role in the development of type-2 diabetes, while its precise origin is yet unknown. Medications, dietary and activity modifications, and

occasionally a mix of the two are used as type-2 diabetes treatment options today. Diabetes is recognized to be the cause of numerous problems that are ongoing, which raise the affliction and death rates associated with the condition. For instance, in the United States, diabetes is the main factor contributing to renal failure, newly diagnosed blindness, and nontraumatic lower extremity amputation.⁴ Both vascular and non-vascular problems can result from diabetes. The vascular consequences include stroke, coronary heart disease, peripheral vascular disease, nephropathy, mono- and polyneuropathy, retinopathy, retinal edema, and autonomic dysfunction. Complications that are not vascular include problems with the digestive system (gastroparesis), skin color changes, an increased risk of infections, cataracts, glaucoma, periodontal disease, and hearing loss. According to the American Diabetes Association (ADA) and European Association for the Study of Diabetes (EASD)'s consensus report for the management of hyperglycemia, the current focus of type-2 diabetes treatment is on avoiding or postponing issues and keeping the patient's life quality. Even while it is advised that people with type-2 diabetes change their lifestyles by being more active, losing weight, and undergoing medical nutrition therapy, the majority of these patients still need to take medication to get their blood glucose levels under control.⁵



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Intermittent Fasting in Diabetes Mellitus

The habit of and oxygen, the party's main fuel beginning, is jolted by diabetes, a never-ending sickness. When you have diabetes, your body either produces insufficient insulin or is too frail to use it well, which can result in elevated glucose levels. According to the 2020 National Population Health Survey, diabetes is a weighty community health question in Singapore, jolting a supposed 34% of those between the ages of 50 and 59. With 1.2% of passing in 2019–2020 and 1.1% in 2021, it is individual of the top 10 chief causes of death. Additionally, it plays an important part in the growth of differing healing environments like renal, courage, and eye afflictions. Thankfully, directing diabetes maybe exhausted by any of habits, individual of that is through a limited diet. This item tests irregular abstaining potential part in a inclusive diabetes administration planning and asks either it's the correct suggest each individual scholar. Reduced calorie consumption on an irregular base is referring to as sporadic abstaining. Depending on moment of truth of era, this can range from any hours to a thorough epoch. Only not spiritual or religious sporadic abstaining for well-being purposes will be debated in this place item, in addition to some attainable or settled benefits and some security issues that grant permission relate to folk accompanying diabetes mellitus, types-1 & 2. Insulin fighting, that is guide corpulence, a fresh incidental determinant of type-2 diabetes, is individual of the main causes in the rise of the affliction. According to Larson-Meyer's (2006) research, growing fat container content alternatively raised fat container dethroning is what causes insulin opposition. Instead, instinctive and hepatic domains are idea to hold the fat containers that cause insulin fighting. The usage of glucose, the body's main fuel source, is impacted by diabetes, a chronic illness.⁶

What is intermittent fasting?

When fasting, one refrains from eating, drinking, or both, depending on the duration of the fast. There are several reasons why people choose to fast, including religious practices, preparation for medical treatments, and weight reduction aimed at improving health. An eating pattern known as intermittent fasting involves periods of consuming very little or no food, followed by regular meals. Unlike many other diets that focus on specific foods, intermittent fasting centers on limiting eating and drinking times. It is often employed for calorie restriction and weight loose purposes. While there are potential benefits for individuals with diabetes, there are associated risks with intermittent fasting.⁷

In recent times, intermittent fasting has gained popularity as a method to enhance body composition and metabolic health. The term "intermittent fasting" refers to dietary habits that revolve around consuming minimal calories during periods lasting from 12hr to several days. Intermittent fasting encompasses various schedules, one of which is alternate day fasting. This regimen

involves alternating between days of eating and fasting. Another approach is periodic fasting, wherein one or more days of the week are spent without food consumption. The most commonly practiced method is time-restricted feeding, which confines eating to a specific daily timeframe, often following 16-20 hr fast.⁸

Benefits of intermittent fasting

A single fasting period in humans, like overnight fasting, can lead to lower baseline levels of various metabolic markers linked to chronic diseases, such as insulin and glucose. For instance, patients need to fast for 8-12 hr before getting blood drawn to attain consistent fasting levels of metabolic substances and hormones. It's crucial to determine if regularly practicing intermittent fasting could be a viable and lasting strategy at the population level to enhance metabolic health. Moreover, well-designed clinical studies are necessary to investigate whether intermittent fasting plans can act as an alternative to or in conjunction with calorie restriction.⁹ These studies should assess whether such regimens can bring about sustained metabolic improvements and aid in managing body weight. The main points presented are grounded in current research evidence. Intermittent fasting approaches aim to adapt the beneficial effects observed in fasting studies on animals like rodents into practical eating patterns for humans (Patterson, Ruth E., and Dorothy D. Sears 2017).¹⁰

Disadvantages of intermittent fasting

There are additional drawbacks to intermittent fasting. It might not be suitable for everyone, especially if they have a medical history or if their sustainable diet needs are not met. Children, teenagers, pregnant women, and nursing mothers may have negative effects from calorie restriction over a longer time period. Diabetes patients and those who are underweight are also affected. People who struggle with eating disorders find it difficult to accept. If you're a working professional, it might be difficult to keep your calorie consumption within a certain time range. Hunger, headaches, and exhaustion are some adverse effects of intermittent fasting.¹¹ Do get advice from a nutritionist or doctor before beginning this diet. Your mood may also be impacted by the strain of adjusting to a new schedule combined with low blood sugar from fasting. Keep in mind that you should resume your usual diet after your fast is finished. For the benefits of intermittent fasting to manifest, it is imperative to forgo any compensatory or special meals.¹²

Effects of intermittent fasting

While intermittent fasting offers numerous advantages, there are also mild and typically non-severe side effects that can occur during fasting, usually not necessitating medical intervention or surgery.¹³ These potential side effects encompass sensations such as dizziness, nausea, insomnia, headaches, weakness, and so on (Grajower MM. *et al.* 2019).¹⁴ Another research investigation has demonstrated that low blood sugar levels (hypoglycemia) can

be a consequence of intermittent fasting (Vasim I, Majeed CN, DeBoer MD, 2022).^{15,16}

Intermittent fasting solution for diabetes

Type-2 diabetes develops largely as a result of insulin resistance. Particularly when linked to obesity, a known contributor to this condition. Larson-Meyer's research in 2006 highlighted that insulin resistance is primarily associated with an increase in the size of fat cells, rather than their quantity. This phenomenon is particularly notable in visceral and hepatic tissues, as indicated by studies by Baumeier in 2015, Wei in 2018, and Kim in 2017.^{17,18} Some studies also propose that muscle tissue with increased fat cells could contribute to insulin resistance. For instance, a study by Baumeier in 2015 showcased that diabetic mice exhibited decreased insulin resistance when fat cell accumulation in muscle tissue reduced. However, a similar human study by Larson-Meyer in 2006 did not find significant lipid changes in muscle tissue.

Recent investigations into intermittent fasting's impact on diabetes imply potential reductions in insulin levels among participants who practice fasting. In diabetic sand rats, an alternate day intermittent fasting regimen of 15 hr led to consistently lower insulin levels compared to non-fasting control rats (Belkacemi *et al.*, 2011).¹⁹ Similarly, Anson and colleagues in 2003 observed decreased insulin levels in mice subjected to a twenty-four-hour alternate day intermittent fasting schedule. Correspondingly, research on prediabetic men aligned with these findings, revealing lowered insulin levels. Notably, the reduction in insulin levels was most pronounced in participants who had higher baseline hyperinsulinemia before starting intermittent fasting. This decrease in insulin levels remained persistent in seven out of eight participants during the seven weeks of monitoring following the five-week fasting phase (Sutton *et al.*, 2018).²⁰

Intermittent fasting's impact on insulin resistance remains inconclusive due to conflicting findings. Some studies on mice suggest potential improvements, while others show no significant changes. Human studies similarly display mixed results, with some reporting reduced insulin resistance following fasting and others finding no significant effects. Notably, a study on type-2 diabetes patients showed promising results, as participants successfully discontinued insulin use through fasting. But additional study is required to comprehend the connection completely in between intermittent fasting and insulin resistance (Sutton *et al.* 2018; Lim 2011), Baumeier (2015), Wei *et al.* (2018).^{1,20} This study on Metabolic Impact of Intermittent Fasting in Patients with Type-2 Diabetes Mellitus: A Systematic Review and Meta-analysis of Interventional Studies aimed to assess the effects of Intermittent Fasting (IF) versus a standard diet on patients with Type-2 Diabetes (T2DM). Seven studies were analyzed, involving 338 participants with T2DM. IF led to greater weight loss (-1.89 kg) compared to a standard diet, especially in heavier individuals (BMI > 36) and shorter-duration studies (≤ 4 months). However, IF didn't show

significant improvement in glycemic control (HbA1c) compared to the standard diet. In conclusion, IF appears to result in more weight loss for T2DM patients without significantly impacting glycemic control (Emily Borgundvaag *et al.* 2021).²¹

For the purpose of enhancing human health, intermittent fasting is being investigated as a potential substitute for Calorie Restriction (CR). In people at risk of type-2 diabetes, a study compared early time-restricted eating and intermittent fasting to calorie restriction and conventional treatment: an issue with several studies randomized controlled trials, though, may be that they failed to consider the significance of when to eat when fasting. IER Intermittent Energy Restriction or iTRE (intermittent restricted energy intake) diets restrict energy intake from one day to a few days a week, followed by intervals of refeeding in the remainder of the week.²² Various versions of IER diets restrict energy from 75% to as low as 10% of the total energy intake required to maintain body weight. Intermittent fasting combined with early time-restricted eating, or iTRE (intermittent restricted energy intake), is a unique strategy. Adults at risk for type-2 diabetes were split into three groups using this strategy: iTRE (fasting from eight AM to twelve PM, followed by a 20 hr fast phase three days a week); CR (eating 70% of daily energy without specified scheduling); and routine treatment. At six months, iTRE demonstrated greater improvement in glucose tolerance compared to CR, albeit this advantage vanished by month eighteen. Greater improvements in post-meal glucose metabolism were produced by iTRE. Occasionally fasting is marked by intervals of regular eating and periods of fasting, has gained popularity as a replacement for CR and has shown comparable benefits for weight loss and health outcomes during fasting.²³ There have only been two powered trials that have investigated the insulin. This study analyzed various interventional studies to assess the impact of Intermittent Fasting (IF) on type-2 diabetes management. The researchers focused on patients with T2DM and evaluated IF's effect on glycemic control using HbA1c levels.²⁴ A systematic review and meta-analysis were conducted on studies published until April 24, 2022, involving complete fasting or intermittent energy restriction. In conclusion, while there's no substantial difference in glycemic control between intermittent fasting and regular diets for managing T2DM, IF could serve as a preventive dietary approach, especially for populations at risk, and may help maintain controlled sugar levels in individuals with prediabetes (Suresh K Sharma, *et al.*).²⁵

The article Clinical Management of Intermittent Fasting in Patients with Diabetes Mellitus tells about Intermittent fasting is gaining popularity for weight loss and treating chronic diseases such as diabetes. However, there is little research on its safety and benefits, especially for diabetics. Current recommendations are often influenced by weight loss trends and animal studies, which lack solid medical guidelines.²⁶ The available evidence includes a single randomized trial and case reports to provide

the basis for proposed evidence-based guidelines for the management of intermittent fasting in patients with type-1 or type-2 diabetes. The article discusses issues related to the safety and effectiveness of diabetes treatment while fasting. With health care provider supervision and glucose monitoring, diabetics can safely continue intermittent fasting. Intermittent fasting in patients with type-1 and type-2 diabetes has shown weight loss and reduced insulin requirements in small human studies.²⁷ However, caution should be exercised when adopting fasting programs for this population. Although animal studies provide initial insights, human studies should guide implementation. Long-term cardiovascular benefits and risks in humans have not yet been fully studied. Enthusiasm for fasting should be balanced with limited human evidence and the need for careful consideration, especially in diabetics.²⁸ Appropriate medication adjustments and blood glucose monitoring can facilitate the safe implementation of intermittent fasting in diabetics. Intermittent fasting in patients with type -1 and type -2 diabetes has shown weight loss and reduced insulin requirements in small human studies. Although animal studies provide initial insights, human studies should guide implementation. Long-term cardiovascular benefits and risks in humans have not yet been fully investigated.²⁹ Enthusiasm for fasting should be balanced with limited human evidence and the need for careful consideration, especially in diabetics. Appropriate medication adjustments and blood glucose monitoring can facilitate the safe implementation of intermittent fasting in diabetics. Diabetes medications such as sulfonylureas, meglitinides, and insulin can cause hypoglycemia; the dose should be adjusted during fasting. Metformin, thiazolidinediones, and DPP-4 inhibitors generally have a low risk of hypoglycemia and can be continued as usual. Changes in fluid intake may require switching to SGLT-2 inhibitors. GLP-1 analogs are different: liraglutide is continued, while lixisenatide can be discontinued.^{30,31} Bromocriptine can be continued. When regulating basal insulin, the risk of fasting blood sugar and hypoglycemia must be considered. Regular glucose monitoring is essential, especially in insulin or sulfonylurea users. Fluid intake may need to be adjusted. Patients with diabetes considering intermittent fasting should consult their healthcare professionals for personalized guidance.

This review focused on Type-2 Diabetes as a metabolic disorder primarily caused by insulin resistance in various tissues. The goal of the study was to determine whether patients with this illness could benefit from intermittent fasting as a non-pharmaceutical therapeutic option. The researchers conducted a comprehensive search through various databases and carefully reviewed articles relevant to the topic. We found that the majority of available research supports the effectiveness of intermittent fasting in managing Type-2 Diabetes. The benefits observed include reduced body weight, fasting glucose levels, fasting insulin levels, insulin

resistance, and lower levels of leptin (a hormone associated with appetite regulation) along with increased levels of adiponectin (a hormone linked to improved insulin sensitivity).³² In certain trials, patients who were properly supervised by their doctors and followed therapeutic intermittent fasting regimens were able to decrease or completely stop needing insulin medication. In conclusion, the available research points to intermittent fasting as a valuable non-pharmaceutical therapy option for Type-2 Diabetes. However, more study is required to separate the particular effects of intermittent fasting from those due to weight reduction, as this element may be responsible for some of the improvements seen. It is advised that doctors become knowledgeable about the possible advantages of intermittent fasting for their diabetes patients. However, before beginning an intermittent fasting program, patients should speak with their doctors since medical supervision is necessary for modifying prescription regimens and for general safety while fasting (Albosta M, *et al.*, 2021).^{26,33}

CONCLUSION

Intermittent fasting holds promise as an adjunctive strategy in the management of type-1 and type-2 diabetes, offering potential benefits such as weight loss and improved insulin sensitivity. While animal studies have provided initial insights into the metabolic mechanisms underlying intermittent fasting, human studies play a crucial role in guiding its implementation in clinical practice. The available evidence suggests that individuals with diabetes can safely engage in intermittent fasting under proper medical supervision, with careful consideration of medication adjustments and fluid intake. However, due to the complexity of diabetes management and the risk of hypoglycemia, a cautious approach is essential. The adoption of intermittent fasting should be accompanied by regular glucose monitoring and close collaboration between patients and healthcare professionals to ensure optimal outcomes. As the research in this area continues to evolve, further studies are needed to fully elucidate the long-term cardiovascular benefits, risks, and optimal fasting protocols for diabetes patients.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

CR: Calorie Restriction; **iTRE:** Intermittent restricted energy intake; **IF:** Intermittent Fasting; **ADA:** American Diabetes Association; **EASD:** European Association for the study of diabetes; **BMI:** Body Mass Index.

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