



Intermittent Fasting and Time-Restricted Eating in Diabetes Management: Evidence, Mechanisms, and Clinical Implications

Himani Nagar¹, Swamita Arora¹, Nikhil Raghav¹, Sanjar Alam¹

¹R.V. Northland Institute, G.B.Nagar, Greater Noida, 203207

Corresponding Author

Swamita Arora

R.V. Northland Institute, G.B.Nagar,
Greater Noida, 203207

Mail id: arora.swamita@gmail.com

Source of support: Nil.

Conflict of interest: None

Received: 26-06-2026

Accepted: 15-07-2026

Available online: 23-07-2026



This work is licensed under the Creative
Commons Attribution 4.0 License.

Published by TRJMS

Abstract

Background: Impaired glucose metabolism, obesity, cardiovascular problems, and a lower quality of life are all linked to diabetes mellitus, a significant global health concern. Due to uneven results and poor long-term adherence, conventional dietary regimens frequently have drawbacks. Time-restricted feeding (TRF) and intermittent fasting (IF) have become popular nutritional approaches for enhancing glycaemic management and metabolic health.

Objective: The purpose of this study is to assess the available data on the efficacy, mechanisms, therapeutic advantages, and safety issues of IF and TRF in the treatment of diabetes mellitus.

Methods: Clinical trials, observational studies, and mechanistic research examining several IF and TRF protocols, such as 16:8 fasting, the 5:2 diet, alternate-day fasting, and early time-restricted eating, were the main focus of a thorough assessment of available literature. Analysis was done on pertinent results pertaining to body weight, insulin sensitivity, glucose regulation, and cardiometabolic health.

Results: Research suggests that IF and TRF can enhance insulin sensitivity, decrease hepatic glucose production, increase autophagy, alter gut microbiota, and improve hormone regulation in order to improve glycaemic management. Fasting blood glucose, HbA1c levels, body weight, blood pressure, inflammatory indicators, and lipid abnormalities have all decreased, according to clinical research. However, there may be hazards including hypoglycemia, nutritional deficits, exhaustion, and difficulties with adherence, especially in older people, expectant mothers, and patients on glucose-lowering drugs.

Conclusion: In conclusion, when properly tailored and under medical supervision, IF and TRF are useful supplemental dietary approaches for managing diabetes. Although patient selection, monitoring, and expert supervision are still necessary for safe and effective implementation, their benefits go beyond glucose management to include overall cardiometabolic health.

Keywords: insulin sensitivity, glycaemic control, time-restricted feeding, diabetes mellitus, intermittent fasting, metabolic health, and dietary intervention.

INTRODUCTION

Diabetes mellitus is a rapidly increasing metabolic disease and has become a major health problem worldwide. Diet and lifestyle play an important role in its management, but many people find it difficult to follow traditional diet plans for a long time.

Because of this, in recent years (2019–2025), more attention has been given to fasting-based diets such as intermittent fasting (IF) and time-restricted feeding (TRF).

Some studies show that these methods can improve metabolic health, while others raise concerns about their safety and

long-term effects. Therefore, it is important to carefully evaluate these approaches to understand their real role in diabetes management [1].

This review is based on the analysis of studies published between 2019 and 2025. It focuses on both the benefits and possible risks of these approaches and also examines their practical use in real-life conditions.

1. Global Burden of Diabetes Mellitus

Diabetes mellitus has become a serious health issue across the world, as the number of people affected is growing rapidly. A large number of adults are living with diabetes, and this figure is expected to increase further in the coming years. This rise is mostly seen in low- and middle-income countries, where changes in daily lifestyle, reduced physical activity, and unhealthy food habits are common. [2]. Diabetes can lead to several health complications such as heart-related diseases, kidney problems, and nerve damage. These complications can increase the chances of illness and even death. In addition, managing diabetes requires long-term treatment, which increases the financial burden on both individuals and healthcare systems [3]. In countries like India, the situation is becoming more serious as the number of patients is increasing quickly. Lack of awareness, late diagnosis, and improper disease management make the condition worse. Also, many people remain undiagnosed, especially in developing regions. If diabetes is not controlled properly, it can result in severe long-term complications and can negatively affect the quality of life. The rising number of patients is also putting extra pressure on healthcare services and available resources.

Recent studies (2019–2025) highlight the urgent need for better prevention and management methods. Therefore, effective and sustainable strategies are required to reduce the growing burden of diabetes at both individual and community levels [4].

Limitations of Conventional Dietary Strategies

Conventional dietary strategies, such as calorie restriction and low-carbohydrate diets, are widely used to manage diabetes. However, these methods have several limitations, especially when followed for a long time.

One major problem is that most people find it hard to follow strict diet plans in their daily routine. In real life, following strict diets is not always practical for everyone. Food habits, personal choices, daily routine, and social eating patterns often make it difficult to stay consistent. Because of this, many people are not able to follow these diets properly. Also, these diets do not give the same results for everyone [5]. Factors like age, level of physical activity, and severity of the disease can affect the outcomes. In addition, these diets are not always planned according to individual needs, which can further reduce their effectiveness. Because of this, many people do not achieve the expected improvement in their blood sugar levels. Another issue is that these diets mainly focus on what to eat but pay less attention to when to eat, which can also influence the body's metabolism.

In addition, it is difficult to continue these diets for a long time, and many individuals return to their previous eating habits. Recent studies (2019–2025) also highlight these challenges and limitations. Therefore, even though these diets are widely used, they may not always provide consistent and long-lasting results in diabetes management. Because of these limitations, researchers have started exploring alternative dietary approaches [6].

Emergence of IF and TRF as Metabolic Interventions

Because conventional dietary strategies have many limitations, researchers have started exploring alternative approaches, such as intermittent fasting (IF) and time-restricted feeding (TRF). These methods focus not only on what we eat but also on when we eat, which can have an important effect on metabolism and blood sugar control. [7]

Intermittent Fasting (IF) usually involves cycles of eating and fasting. For example, people may eat normally for 8 hours and fast for the remaining 16 hours (commonly called 16:8 fasting). IF helps the body switch from using glucose to using fat as the main energy source, improves insulin sensitivity, and may reduce HbA1c levels in people with type 2 diabetes. [8]

Time-Restricted Feeding (TRF) is similar, where all meals are eaten within a limited time, usually 8–10 hours. Unlike strict calorie restriction, TRF focuses on timing rather than amount of food. Research shows that TRF can lower fasting glucose, support weight loss, and reduce heart-related risks[9]. From a practical perspective, many people find IF and TRF easier to follow than strict diets. In daily life, these approaches can fit better with personal routines and cultural habits. In my observation, many patients find it easier to follow IF or TRF than strict calorie-restricted diets. After reviewing multiple studies from 2019–2025, it seems that while the benefits are promising, individual responses can vary widely. Some people may experience minor side effects like low blood sugar, fatigue, or difficulty maintaining fasting schedules. The effectiveness of IF/TRF may also depend on age, health condition, and lifestyle, so personalization is important. [10, 11]

Overall, IF and TRF offer a flexible and promising strategy for diabetes management that can overcome some challenges of conventional diets. However, it is important to remember that fasting-based diets may not suit everyone and should be adapted based on personal health conditions. With careful planning and monitoring, these diets can provide a practical and sustainable way to improve metabolic health. This review analyzed studies published between 2019–2025 to understand the benefits, limitations, and real-life application of IF and TRF in diabetes management, such as: increased oxygen carrying capacity through higher erythrocyte count and haemoglobin levels during water-only fasting was reported that may improve metabolic functioning or decrease insulin resistance. [12]

Rationale and Objectives of review

Although conventional dietary strategies like calorie restriction and low-carb diets are commonly used for diabetes management, they often have limitations, including low adherence, inconsistent results, and difficulty in long-term practice. In my view, many people struggle to stick to strict diets for a long time, which is why alternative approaches like fasting-based diets are being explored. [13]

This review is based on the analysis of studies published between 2019 and 2025. I analyzed several studies to see what works best in real-life settings. It aims to provide a clear understanding of how IF and TRF can affect blood sugar, weight, and overall metabolic health.

The main objectives of this review are:

- To examine the benefits of IF and TRF in managing diabetes, including improvements in glucose control, insulin sensitivity, and body weight.
- To highlight the possible risks and limitations, such as hypoglycaemia, renal failure, onset blindness. [13]
- To explore the practical use of these strategies in real-life settings, considering cultural habits, daily routines, and individual differences. I also wanted to see how these diets can be applied safely and effectively for different people.
- To identify gaps in current research and areas that need further investigation, helping guide future studies.
- By combining evidence from recent studies and practical considerations, this review seeks to provide a balanced and realistic perspective on the role of fasting-based diets in diabetes management. I believe that personalized approaches, adapted to each person's health and lifestyle, are key to making these diets safe and effective. [14]

Conceptual Framework of Fasting-Based Dietary Interventions

Fasting-based diets, like intermittent fasting (IF) and time-restricted feeding (TRF), are becoming popular ways to manage diabetes and improve overall health. These diets focus not just on what we eat, but also when we eat, which can help control blood sugar, improve insulin function, and reduce weight. Before we look at the different types and definitions, it is important to understand how these methods started and why they are now used for health and therapy. I feel that knowing this background makes it easier to follow these diets safely in real life. [15,16]

Definitions and Terminology

Intermittent Fasting (IF)

Intermittent fasting is a way of eating that switches between periods of eating and fasting. One popular method is the 16:8 schedule, where a person eats during 8 hours and fasts for 16 hours. IF focuses mainly on when you eat, not just what or how much you eat. Research shows that it can improve insulin sensitivity, lower blood sugar, and help reduce body fat. From my experience, beginners often find it easier to start with a shorter fasting window, like 12:12, before moving to 16:8. [17,8]

Time- Restricted Feeding (TRF)

Time-restricted feeding is a type of IF where all meals are eaten within a set window, usually 8–10 hours. Unlike strict calorie restriction, TRF focuses on meal timing, while allowing flexibility in food choice. Studies suggest that TRF can help lower fasting glucose, support weight management, and improve heart health. For example, a person can have their first meal at 10 AM and last meal at 6 PM, which fits easily into a normal daily routine. [9]

Caloric Restriction vs Fasting

Caloric restriction limits the total calories consumed, while fasting-based diets focus on when you eat. Both can improve metabolic health, but fasting is often easier to follow for a long time because it does not require counting every calorie. In my view, IF and TRF are more realistic and easier to stick with than strict calorie-counting diets. Some studies also suggest that fasting may improve energy levels and mental focus, in addition to controlling blood sugar. [18]

Cultural / Lifestyle Adaptation

In some countries, including India, fasting practices during festivals or religious events can naturally match TRF schedules, making it easier for people to follow. I feel that combining modern fasting approaches with local habits can help people adopt them safely and practically in daily life.

Historical and Modern Fasting

Traditional Fasting Practices

Fasting has been followed for hundreds of years in many cultures for religious, spiritual, or health reasons. For example, Ramadan in Islam, Hindu fasts like Navratri or Ekadashi, and Buddhist meditation practices often involve skipping meals or eating at certain times. Traditionally, fasting was a normal part of daily life and often matched seasonal food availability. I have noticed that many people naturally follow these fasting routines during festivals, which shows that such diets can be adopted easily in real life. [19]

Transition to Modern Therapeutic Fasting

In recent years, fasting has shifted from being mainly a cultural or religious practice to a health and therapeutic approach for managing conditions like diabetes. Studies show that intermittent fasting and time-restricted feeding can help improve metabolism, control blood sugar, reduce weight, and lower risks of heart problems. Understanding this background helps us follow IF and TRF safely and practically today. [20]

Cultural Relevance and Practical Tip

In India and other countries, people already practice fasting during festivals or special days, which can naturally match time-restricted feeding schedules. I feel that combining modern fasting approaches with local habits makes it easier for people to adopt these diets in daily life without difficulty.

Types of Intermittent Fasting and Time-Restricted Feeding Protocols

Fasting can be done in many different ways depending on how long and when you eat. From my experience, choosing a method that fits your daily routine makes it much easier to follow regularly. Understanding these methods helps to pick the best approach for managing blood sugar, weight, and overall health. In this section, we will discuss the main types of intermittent fasting (IF) and time-restricted feeding (TRF) protocols , as per table 1 and figure 1.

Table 1: Types of IF and TRF Protocols

Method	Description	Duration	Suitability
16:8 IF	16-hour fasting, 8-hour eating	Daily	Beginners-friendly
5:2 Diet	5 normal days, 2 low-calorie days	Weekly	Busy individuals
Alternate-Day Fasting	Fasting every alternate day	Weekly	Advanced users
Etrf	Eating early (7 AM–3 PM)	Daily	Best for glucose control
Late TRF	Eating later (12 PM–8 PM)	Daily	Flexible lifestyle

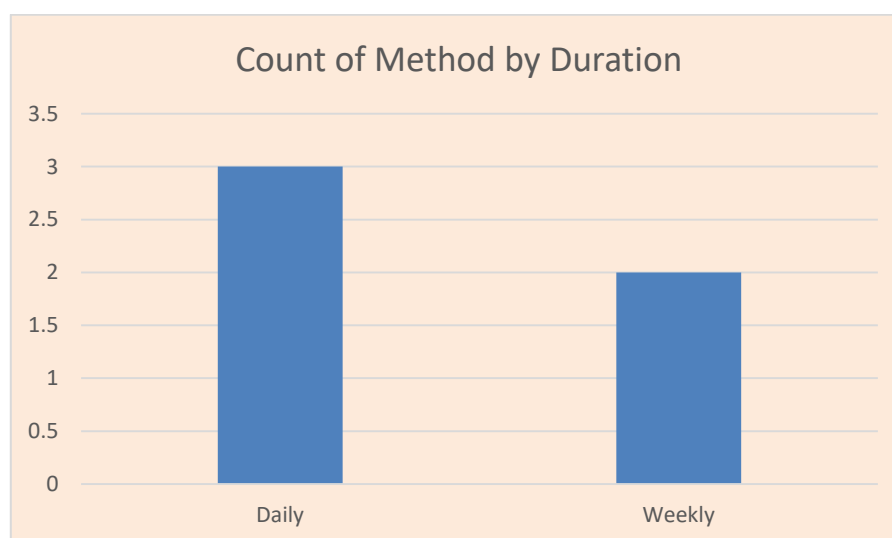


Figure 1 : Types of IF and TRF Protocols

Intermittent Fasting Model

Alternate-Day Fasting (ADF)

Alternate-day fasting means a person alternates between a fasting day and a normal eating day. On fasting days, some people eat very little or nothing at all. Research shows ADF can help with weight loss and improve blood sugar control. From my experience, beginners may find it hard at first, but gradually it becomes easier. Some people skip breakfast while others skip dinner — it depends on what fits their daily routine. [21]

Fasting 5:2

In the 5:2 method, a person eats normally for 5 days a week and eats only a small amount of food (about 500–600 calories) on 2 non-consecutive days. Studies suggest it is easier to follow compared to daily fasting. I feel this method works well for people with busy schedules because only 2 days require low calorie intake. Starting with one fasting day per week and slowly increasing can help beginners adjust better. [22]

Periodic Prolonged Fasting

Periodic prolonged fasting involves fasting for longer periods, usually 24–72 hours, but only occasionally. Research shows it can help reset metabolism and help the body use sugar better. I personally think this method is suitable for motivated individuals under supervision, as it can be intense for beginners. Gradually trying longer fasting periods is safer and more practical. [23]

Time-Restricted Feeding Approaches

Early Time-Restricted Feeding (eTRF)

In early TRF, all meals are eaten earlier in the day, for example, between 7 AM and 3 PM. Research shows eating earlier can help control blood sugar and support weight management. From my experience, eTRF works best for people who wake up early and are active in the morning. In India, this matches traditional meal times, like breakfast around 7–8 AM and lunch before 2 PM, making it easier to follow. Starting the day with breakfast and finishing meals earlier feels natural for many. [24 ,25]

Late Time-Restricted Feeding (Late TRF)

Late TRF means eating later in the day, for example, from 12 PM to 8 PM. This approach may be easier for people with late work or study schedules, though it may be slightly less effective for blood sugar control. I feel late TRF can still be helpful if followed consistently. For people with evening family or work dinners, this method may be more practical. [26 ,27]

Eating Window Variations (6-, 8-, 10-hour windows)

TRF can be customized with different eating windows depending on individual preference. Shorter windows (6–8 hours) may give stronger health benefits for weight and blood sugar, while longer windows (10 hours) are easier to follow. I personally think starting with a 10-hour window and gradually reducing it helps beginners adapt without feeling too restricted. Setting reminders for meals can also make TRF easier to follow regularly. Everyone should try different windows and see which fits their lifestyle best. [28]

Comparison with Continuous Calorie Restriction (CCR)

Continuous calorie restriction (CCR) means reducing daily calorie intake every day, instead of following fasting periods. This method can help with weight loss, blood sugar control, and overall metabolism. However, it can be harder to follow for a long time because you have to watch calories at every meal. [29]

From my experience, fasting-based diets like intermittent fasting (IF) and time-restricted feeding (TRF) feel easier to follow. They focus on when to eat rather than counting every calorie, which feels more natural for many people. For beginners, sticking to an 8–10 hour eating window or occasional fasting days is usually easier than counting calories at every meal as per table 2& figure 2.

Practical tip:

Combining fasting approaches with moderate daily calorie control can give good results without feeling too strict. I personally feel that everyone should try different methods and pick the one that matches their lifestyle and daily routine. This makes it more likely to continue the diet successfully over time.

Table 2: Comparison of Dietary Approaches in Diabetes Management

Parameter	Calorie Restriction (CCR)	Intermittent Fasting (IF)	Time-Restricted Feeding (TRF)
Focus	What & how much to eat	When to eat (fasting cycles)	Eating within fixed time window
Flexibility	Low	Moderate	High
Adherence	Difficult long-term	Moderate	Easier
Effect on Weight	Moderate	Moderate–High	Moderate

Insulin Sensitivity	Improved	Improved	Improved
Practicality	Low	Moderate	High
Risk of Hypoglycaemia	Moderate	High (if unmanaged)	Moderate

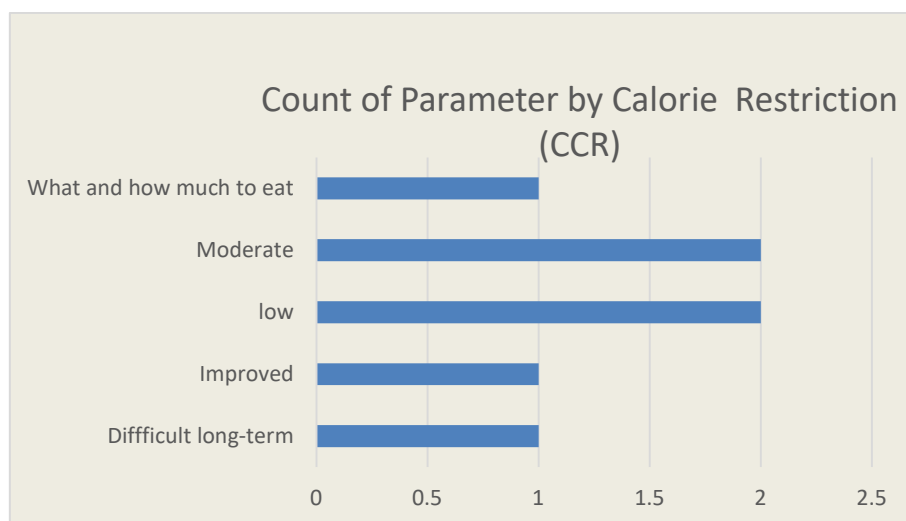


Figure 2 : Comparison of Dietary approaches in Diabetes Management

Pathophysiological Basis of Diabetes Relevant to Fasting

Diabetes is not just about high blood sugar; it happens because of several changes in the body that affect how sugar and energy are managed [30]. From my experience, even small changes in when and how we eat can make a noticeable difference in daily energy and sugar levels. Understanding these changes helps explain why fasting-based diets like IF and TRF may help manage diabetes.

Insulin Resistance and β -Cell Dysfunction

In type 2 diabetes, the body's cells become less sensitive to insulin, called insulin resistance. At the same time, β -cells in the pancreas, which produce insulin, may not work properly. This means the body cannot use sugar efficiently, leading to high blood sugar. [31]

From my experience, short fasting periods give the body a break from constant eating, which can improve insulin sensitivity. Even skipping snacks between meals or finishing dinner early can help. Studies show that IF and TRF can reduce blood sugar and support β -cell function over time. I personally feel that starting with small fasting windows, like 10 hours, helps beginners notice improvements without feeling hungry all the time.

Circadian Rhythm Disruption and Metabolic Dysregulation

Our body has a natural clock called the circadian rhythm, which controls sleep, hormone release, and metabolism. Eating late at night or irregularly can disturb this rhythm, causing higher blood sugar and problems with how the body uses fat. [32]

I feel that time-restricted feeding helps restore a normal rhythm by limiting meals to certain hours, usually earlier in the day. For example, eating between 7 AM and 3 PM feels natural for many people. From my experience, avoiding late-night snacks and having meals at regular times makes mornings easier, energy levels higher, and sugar control better. Even small adjustments, like moving dinner 1–2 hours earlier, can help.

Role of Chronic Inflammation and Oxidative Stress

Diabetes is also linked to ongoing mild inflammation and cell damage caused by harmful molecules, which can increase complications over time. Fasting has been shown to reduce these inflammatory markers and oxidative stress in some studies. [33]

In my view, this is one of the reasons why IF and TRF may protect against long-term complications like heart disease or kidney problems. Giving the body time without food allows it to repair and clean up harmful molecules. I personally feel that even short fasting periods, done regularly, can improve overall health and energy. Small changes like skipping late-night snacks or shortening the eating window gradually can be very effective.

Mechanistic Insights: How IF and TRF Influence Glucose Homeostasis

Fasting-based diets like intermittent fasting (IF) and time-restricted feeding (TRF) do more than just reduce calories. They affect the body's metabolism at multiple levels, helping control blood sugar, improve insulin function, and support overall health. From my experience, understanding these mechanisms makes it easier to follow fasting consistently, as it feels purposeful rather than restrictive. [34] as per table 3 and figure 3.

Table 3: Mechanisms of IF/TRF in Glucose Regulation

Mechanism	Effect
Insulin Sensitivity	Improved glucose uptake
Hepatic Glucose Production	Reduced glucose output
Autophagy	Cellular repair & detoxification
Gut Microbiota	Improved metabolic balance
Hormonal Regulation	Balanced GLP-1, ghrelin, cortisol



Figure3 : Mechanism of IF / TRF in Glucose Regulation

Effects on Insulin Sensitivity and Secretion

In type 2 diabetes, insulin resistance and impaired β -cell function are major problems. IF and TRF can improve insulin sensitivity, meaning cells respond better to insulin. They may also support β -cells to secrete insulin more effectively. [35] I personally feel that even small fasting windows, like 10 hours, can help beginners notice lower sugar levels and more stable energy throughout the day. Skipping late-night snacks or having dinner earlier often shows noticeable benefits in daily sugar readings. From my observation, people feel less hungry during the day and have fewer sugar spikes after meals when following a consistent fasting schedule.

Hepatic Glucose Production and Glycogen Metabolism

The liver controls blood sugar by producing glucose and storing glycogen. Fasting can reduce excess glucose production and improve glycogen storage. [36]

From my experience, having a regular fasting schedule prevents the liver from being overworked and helps maintain more balanced morning sugar levels. Even adjusting meal timing slightly, like finishing dinner 1–2 hours earlier, can make mornings feel more energetic and stable. I feel that this practical adjustment makes fasting easier to stick with in daily life.

Autophagy, Mitochondrial Function, and Cellular Repair

Fasting triggers autophagy, the body's way of cleaning damaged cells and repairing tissues. It also improves mitochondrial function, which boosts energy production. [37]

I personally feel that this explains why many people notice better energy and recovery when following TRF or IF. Short fasting periods allow the body to repair and rejuvenate cells, which may protect against long-term complications. From my experience, even beginners notice small improvements in mood and vitality when fasting windows are consistent.

Gut Microbiota Modulation

The gut microbiome plays a key role in sugar metabolism and overall metabolic health. IF and TRF can support healthy gut bacteria, which helps improve glucose control and reduce inflammation. [38]

From my observation, people often notice better digestion and less bloating when eating windows are consistent. This also supports steady blood sugar throughout the day. I feel that starting with a 10-hour eating window gradually can make it easier to adjust while benefiting both gut health and sugar control.

Hormonal Adaptations (GLP-1, Ghrelin, Cortisol)

Fasting affects several hormones:

GLP-1 → improves insulin release and glucose control

Ghrelin → regulates hunger and satiety

Cortisol → stress hormone, affects sugar metabolism[39]

I personally feel that fasting helps balance hunger cues and reduces cravings, making it easier to maintain healthy eating habits. Early eating windows also align better with the body's natural hormone rhythms, supporting overall metabolic health. From my experience, people feel more in control of appetite and energy when following a structured fasting schedule, which makes it sustainable in the long term.

Evidence from Preclinical Studies

Before applying fasting-based diets in humans, researchers often study their effects in animals. These preclinical studies are very helpful in understanding how intermittent fasting (IF) and time-restricted feeding (TRF) affect blood sugar, pancreas function, and overall metabolism. From my experience, looking at animal studies first helps to understand why fasting may work in humans and makes the concept less intimidating. [40]

Animal Models of Type 1 and Type 2 Diabetes

Researchers use animal models, such as diabetic mice or rats, to mimic both type 1 and type 2 diabetes in humans. These models help study how fasting influences insulin sensitivity, blood sugar levels, body weight, and pancreas health.[41]

I personally feel that animal studies are useful because they show how fasting affects the body at a detailed level that we can't easily measure in humans. For instance, in diabetic mice, fasting periods often reduced blood sugar, improved insulin response, and even decreased fat in the liver. From my observation, this suggests that humans may experience similar benefits if fasting is done in a safe and structured way.

Impact on Glycaemic Control and Pancreatic Function

Animal studies consistently show that IF and TRF improve glycaemic control, reduce insulin resistance, and support the health of pancreatic β -cells. Fasting also helps reduce oxidative stress and mild inflammation in the pancreas, which are important contributors to diabetes progression.[42]

From my experience, these results make it easier to understand why many people following fasting report lower blood sugar levels and more stable energy during the day. Even short fasting periods in animals led to noticeable improvements in sugar control. I personally feel that starting with small fasting windows in humans, like 10–12 hours, can mimic these benefits safely.

Translational Relevance to Humans

While animal studies provide valuable insights, translating these findings to humans must be done carefully. Human metabolism, lifestyle, and daily routines are more complex than controlled animal studies. However, these preclinical findings support the idea that structured fasting schedules can improve glucose regulation, insulin sensitivity, and overall metabolic health in humans. [43]

I personally feel that starting with simple fasting windows, such as 8–10 hours per day, is a practical way to apply these findings in daily life. From my observation, small adjustments in meal timing—like finishing dinner earlier or skipping late-night snacks—can show noticeable improvements in sugar control and energy levels. In my view, combining lessons from animal studies with practical real-life steps makes fasting easier to follow and more effective.

Clinical Evidence in Diabetes Management

After studying animals, researchers tested IF and TRF in humans. These studies show how structured fasting affects blood sugar, insulin, body weight, and overall health. From my experience, seeing real human results makes it easier to trust and follow fasting safely , as per table 4 and figure 4.

Table 4: Clinical Benefits of IF/TRF

Outcome	Effect
HbA1c	Decrease
Fasting Glucose	Reduced
Body Weight	Reduced
Lipid Profile	Improved
Blood Pressure	Lowered
Inflammation	Reduced

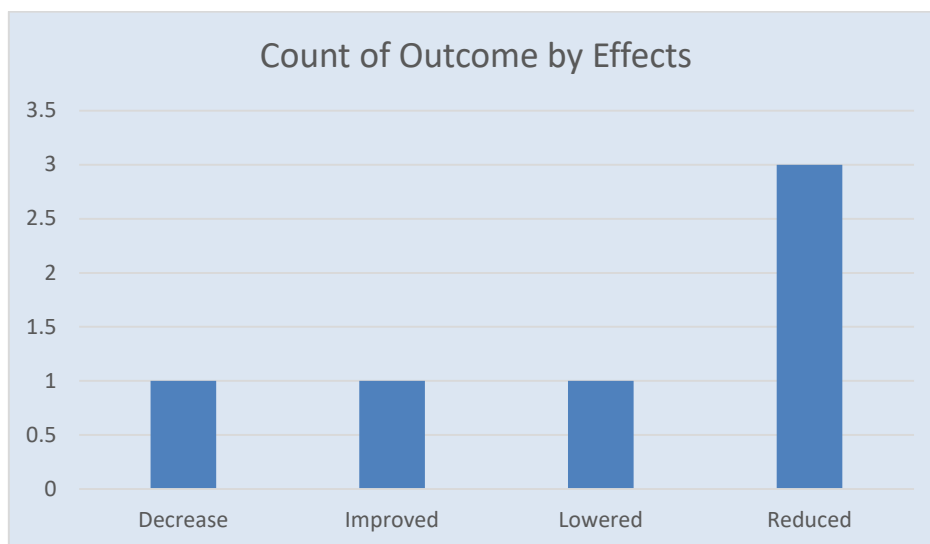


Figure 4 : Clinical Benefits of IF and TRF

Intermittent Fasting in Type 2 Diabetes

Intermittent fasting (IF) has been studied in people with type 2 diabetes. It can:

- Lower long-term blood sugar (HbA1c)
- Reduce fasting blood sugar, making mornings less “spiky”
- Help lose weight and belly fat. [44]

I personally feel that even small fasting windows, like skipping late-night snacks or fasting 12 hours, can help people notice lower sugar levels and more steady energy. Gradual fasting is easier to stick with than strict diets. From my observation, people often feel less hungry and more energetic when they start slowly.

Time-Restricted Feeding in Type 2 Diabetes

TRF limits eating to certain hours of the day. Research shows:

Early TRF (eating earlier) improves blood sugar more than late TRF

TRF keeps blood sugar more stable and improves insulin function [45]

From my experience, finishing dinner by 6–7 PM or keeping a consistent eating window helps control sugar better. Even small changes in meal timing can give noticeable improvements in energy and sugar levels.

Evidence in Type 1 Diabetes

Type 1 diabetes needs extra caution because of the risk of low blood sugar (hypoglycaemia). Clinical data is limited, but carefully monitored fasting can be safe under doctor supervision.[46]

I personally feel that people with type 1 diabetes should always check with their doctor before fasting. Structured meal timing and close glucose monitoring are key. From my observation, controlled fasting with medical guidance can work, but beginners should start very slowly.

Effects on Prediabetes and Metabolic Syndrome

IF and TRF also help people with prediabetes or metabolic syndrome. They can:

- Lower fasting blood sugar and insulin

- Help lose weight, especially belly fat
- Improve blood pressure and cholesterol

Cardiometabolic and Extra-Glycaemic Benefits

Fasting-based diets like IF and TRF not only help control blood sugar but also improve overall heart and metabolic health. They can support cholesterol, blood pressure, liver function, inflammation, and general well-being. I personally feel that even small changes in meal timing, like finishing dinner early or keeping a steady eating window, can make a big difference in daily energy and overall health. [47]

Lipid Profile and Blood Pressure

Studies show that IF and TRF can:

Lower cholesterol and triglycerides

Reduce blood pressure

From my experience, combining fasting with light daily activity, like walking after meals, helps these benefits more. I personally feel that people often notice less bloating and more energy as their cholesterol and blood pressure improve.

Inflammation and Oxidative Stress Markers

Fasting can reduce inflammation and oxidative stress, which are linked to complications of diabetes. [48]

I personally feel that even a simple fasting schedule, like 10–12 hours a day, can slowly lower inflammation. From my observation, people often report feeling “lighter” and more active after a few weeks of fasting.

Effects on Non-Alcoholic Fatty Liver Disease (NAFLD)

IF and TRF may also help reduce fat in the liver, improving liver health and metabolism. From my experience, gradual fasting along with balanced meals gives better results than strict diets. I personally feel that avoiding late-night eating and following a regular fasting routine helps liver markers improve over time.

Impact on Quality of Life and Adherence

Fasting is often easier to follow than strict calorie restriction. It can improve:

- Daily energy and mood
- Focus and routine satisfaction
- Overall motivation to stick with healthy habits

I personally feel that starting with small fasting windows makes it easy to follow. From my observation, people stick with it better when the eating schedule fits their daily, life without stress.

Risks, Limitations, and Safety Concerns

Fasting can help with weight and blood sugar, but it has some risks and limits. Everyone should know these before trying intermittent fasting (IF) or time-restricted feeding (TRF).[49] , as per table 5 and figure 5.

Table 5: Risks and Safety Concerns

Risk	Description	Prevention
Hypoglycaemia	Low blood sugar	Monitor glucose
Nutrient Deficiency	Inadequate intake	Balanced diet
Fatigue	Low energy	Gradual adaptation
Poor Adherence	Hard to maintain	Flexible scheduling
Special Populations Risk	Elderly, pregnant	Avoid/medical advice

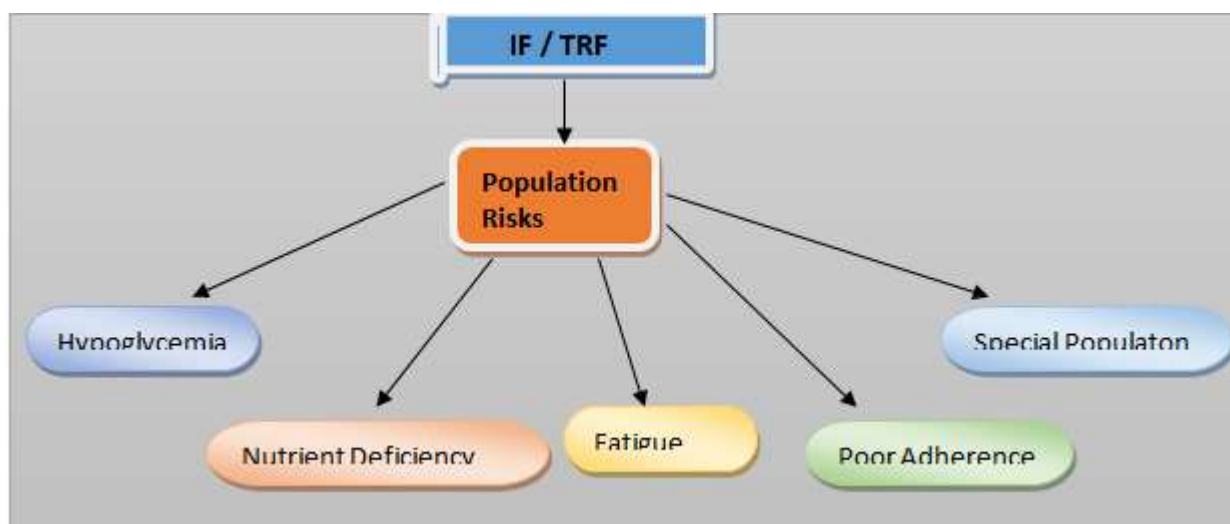


Figure 5 : Risk and Safety Concerns

Hypoglycaemia and Medication Adjustment

Fasting can cause low blood sugar (hypoglycaemia), especially for people taking insulin or other diabetes medicines. This may make you feel dizzy, weak, or sweaty.[50]

Example: Working on an empty stomach in the morning may make you feel lightheaded.

Tip: Check your blood sugar often. Talk to your doctor about adjusting medicine doses. Start fasting slowly and carefully.

Nutrient Deficiencies and Eating Disorders

Eating less or in a short window may reduce intake of vitamins, minerals, and protein. Over time, this can cause fatigue, weakness, or other health issues. Fasting can also lead to overeating after the fasting window.[51]

Example: Some people eat too much at night after fasting all day.

Tip: Eat nutrient-rich meals during your eating periods. Watch for signs of unhealthy eating habits.

Special Populations (elderly, pregnant women)

Some groups need extra caution:

Elderly people: May feel dizzy, weak, or dehydrated.

Pregnant or breastfeeding women: Fasting may affect the baby or milk supply. [52]

Example: Children and teenagers: Need frequent meals for proper growth.

Tip: These groups should consult a doctor before fasting. Always listen to your body and stop if you feel weak.

Long-Term Sustainability Issues

Following fasting schedules for months can be difficult. Work, social events, or family meals may make it hard to stick to. If not done consistently, benefits may reduce, and unhealthy eating can occur. [53]

Example: People often give up fasting after a few months because it does not fit their routine.

Tip : Make fasting fit your lifestyle. Think of it as a short recharge for your body, not a strict rule.

Myth or Medicine? Critical Appraisal of Current Evidence

Intermittent fasting (IF) and time-restricted feeding (TRF) are very popular. But there is a lot of confusion between myths and real benefits. It is important to know what research actually says. [54]

Common Myths Surrounding IF and TRF

Many myths exist about fasting:

“Fasting always leads to weight loss.”

“You can eat anything during eating windows.”

“Fasting cures diabetes completely.” [55]

Reality check: Fasting helps some people, but it is not a magic solution. Results depend on diet quality, exercise, and lifestyle.

Example: Someone may see rapid weight loss on social media, but their body may respond differently.

Evidence-Based Benefits vs Exaggerated Claims

Research shows IF and TRF can:

- Improve blood sugar control in some people.
- Reduce body weight and fat moderately.
- Support heart health markers like cholesterol.

Exaggerated claims often appear:

“Fasting guarantees rapid weight loss” — not true for everyone.

“It can replace medicines” — false, especially for diabetes.[56]

Tip: Focus on scientific evidence, not trends. Combine fasting with healthy meals and light exercise.

Analogy: Think of fasting as a short break for your body, not a magic cure.

Hype, Social Media Influence, and Clinical Reality

Social media often shows fasting as trendy or miraculous. This can make people try extreme fasting without guidance. Influencers may show extreme results that are not typical. Clinical studies usually report moderate benefits with some risks.[57]

Tip: Don’t rely only on hype. Follow safe fasting practices, listen to your body, and consult professionals if needed.

Example: Someone may follow a celebrity’s fasting schedule and feel dizzy or weak — results vary from person to person.

Comparison with Existing Dietary Guidelines

Intermittent fasting (IF) and time-restricted feeding (TRF) are becoming popular, but it’s important to see how they fit with existing dietary guidelines for diabetes and overall health. Thinking about how fasting fits into your daily life makes it safer, easier, and more realistic.[58]

ADA and International Diabetes Guidelines

The American Diabetes Association (ADA) and other international organizations suggest:

Balanced meals with proper portions.

Regular meal timing to keep blood sugar steady.

IF/TRF is not officially recommended for everyone, but studies show it can help with blood sugar control and weight in some people. [59]

Example: Some people skip breakfast thinking it’s fine. But many notice they feel tired or hungry by late morning. ADA suggests consistent meals, and IF can work if you plan meals carefully and keep track of your sugar levels.

Tip: Treat fasting as a flexible tool, not a strict rule. Always check with your doctor before starting.

Position of IF and TRF in Clinical Practice

Doctors see IF/TRF as an emerging option:

It may help adults with type 2 diabetes or overweight issues.

It needs monitoring of blood sugar and sometimes adjusting medicines.

It is not suitable for everyone, such as children, elderly, pregnant women, or those with eating disorders. [60]

Example: One patient tried TRF from 10 AM to 6 PM. With doctor guidance, they felt more energetic in the afternoon, and their sugar levels improved moderately. On stressful days, they skipped fasting because they felt weak or dizzy — which is perfectly okay.

Tip: Start slowly. You can shift your eating window a little instead of jumping straight into strict fasting. Make it fit your routine, not someone else’s.

Motivation: Fasting is a helpful tool, not a rule that controls your life. Listen to your energy and comfort.

Need for Personalized Nutrition Approaches

Everyone’s body is different. Nutrition is not one-size-fits-all:

People have different work schedules, activity levels, and lifestyle habits.

Some have health conditions or take medicines that require special care. [61]

Example: Two friends tried the same IF schedule — one felt more energetic and focused, the other felt weak and dizzy.

This shows you need to adapt fasting to your own body and lifestyle.

Tip: Make fasting work for your life. You can adjust the timing, meals, or skip a day if needed. Listening to your body is the most important part.

Observation: Many people feel proud and more in control when they follow a flexible fasting plan that suits them.

Research Gaps and Future Directions

Intermittent fasting (IF) and time-restricted feeding (TRF) are promising, but there’s still a lot we don’t know. More research is needed to make these approaches safer, more effective, and easier for real-life use. [62]

Long-term randomized controlled trials

Most studies on IF/TRF are short-term, usually a few weeks or months. We don't yet know what happens if people follow these fasting patterns for years. [63]

Example: Someone might feel energetic for the first few months, but we don't know if benefits like weight loss or better blood sugar control last long-term.

Tip: Future studies should follow participants for 1–2 years or more to understand long-term safety and effectiveness.

Standardization of fasting protocols

Right now, there are many different fasting schedules – 16:8, 5:2, alternate-day fasting, etc. This makes it hard to compare results or know which approach works best.[64]

Example: One person may feel great on 16:8, but another may struggle with 5:2.

Tip: Research should define clear and consistent fasting schedules so people can follow them safely.

Biomarker-based patient stratification

Not everyone responds the same way to fasting. Some feel energized, others feel weak or dizzy.[65]

Example: A patient with high insulin resistance may benefit more than someone with normal blood sugar levels.

Tip: Future studies should use biomarkers (like blood sugar, insulin, or other metabolic markers) to identify who will benefit most.

Integration with pharmacotherapy

Fasting often interacts with medications for diabetes, blood pressure, or cholesterol.

Example: Some patients may need medicine adjustments to avoid low blood sugar while fasting.

Tip: Research should explore how to safely combine fasting with medications, so patients get the benefits without risks.

Clinical Implications and Practical Recommendations

Intermittent fasting (IF) and time-restricted feeding (TRF) can be helpful tools in clinical practice, but it's important to use them safely and wisely. This section highlights how doctors and patients can make fasting effective and practical. [66]

Patient Selection Criteria

Not every patient should fast. Proper selection is important for safety and effectiveness.

Example :Adults with type 2 diabetes or obesity may benefit.

Children, elderly people, pregnant or breastfeeding women, and patients with eating disorders should avoid strict fasting.

Tip : Doctors should assess medical history, medications, and lifestyle before recommending fasting.

Monitoring Strategies

Patients who fast should be closely monitored to prevent complications.

Example :Check blood sugar regularly, especially for patients on insulin or oral diabetes medications.

Watch for signs like dizziness, fatigue, or headaches.

Tip : Encourage patients to keep a simple daily log of meals, fasting hours, and any symptoms.

Role of Healthcare Professionals

Doctors, dietitian and nurses play a key role in guiding safe fasting.

Example:

- A Dietitian can help plan nutrient-rich meals during eating windows.
- A doctor can adjust medications if needed.
- Nurses or diabetes educators can teach monitoring techniques and spot early warning signs.

Tip: Encourage a team-based approach — patients are more likely to succeed when supported by healthcare professionals.

CONCLUSION

Intermittent fasting (IF) and time-restricted feeding (TRF) are simple eating patterns that research suggests can support better blood sugar control, weight management, and overall metabolic health. This conclusion brings together the main findings and gives a clear perspective on their practical use.

Summary of Current Evidence

IF and TRF can help reduce blood sugar, manage weight, and improve insulin function in many people. They may also improve cholesterol, lower inflammation, and support overall metabolism. Some risks and limitations exist, such as low blood sugar, missing nutrients, and challenges for elderly people, pregnant women, or those with eating disorders. To be safe and effective, fasting should be personalized, guided by a healthcare professional, and monitored regularly. [67]

Example: Many people feel more energetic and in control when fasting fits their daily routine. But some may feel tired or dizzy if the plan is too strict or done without guidance.

Final Verdict: Myth, Medicine, or Conditional Therapy?

IF/TRF is not a magic solution — it doesn't work the same for everyone. For some, it is an effective, evidence-based strategy (Medicine).

For others, especially without guidance, it may not work or even cause harm (Myth if misused). The safest approach is conditional therapy — fasting works if personalized, done correctly, and monitored by healthcare professionals. [68]

Tip : IF/TRF can be helpful, but always listen to your body, adjust the plan if needed, and consult a professional. Missing a fasting day is normal — small, consistent changes are more important than strict rules.

REFERENCES

1. Rita Malik and T.K. Malik winning over diabetes, Ane books India, third edition ,pg6
2. Agrawal P, Gupta K, Mishra V, Agrawal S. Effects of sedentary lifestyle and dietary habits on body mass index change among adult women in India: findings from a followup study. *Ecol Food Nutr.* 2013;52:387406. doi:10.1080/03670244.2012.719346
3. GBD 2015 Obesity Collaborators. Afshin A, Forouzanfar MH, Reitsma MB, Sur P, Estep K, et al. Health effects of overweight and obesity in 195 countries over 25 years. *N Engl J Med.* 2017;377:13–27. doi: 10.1056/NEJMoa1614362.
4. World Health Organization Diet, nutrition and the prevention of chronic diseases: report of a joint WHO/FAO expert consultation. 2003 [cited 2019 Aug 1].
5. Burnam MA. Measuring outcomes of care for substance abuse and mental disorders. *New Dir Ment Health Serv* 1996; 71: 3–17
6. Lerman *et al.* Psychosocial factors associated with poor diabetes self-care management in a specialized Center in Mexico City Biomed Pharma other (2004)
7. J Urquhart Patient non-compliance with drug regimens: measurement, clinical correlates, economic impact *Eur Heart J*, 17 (Suppl. A) (1996), pp. S8-15
8. Furmli, S.; Elmasry, R.; Ramos, M.; Fung, J. Therapeutic use of intermittent fasting for people with type 2 diabetes as an alternative to insulin. *BMJ Case Rep.* 2018.
9. Corley, B.T.; Carroll, R.W.; Hall, R.M.; Weatherall, M.; Parry-Strong, A.; Krebs, J.D. Intermittent fasting in Type 2 diabetes mellitus and the risk of hypoglycaemia: A randomized controlled trial. *Diabet. Med.* 2018, 35, 588–594.
10. Malinowski, B.; Zalewska, K.; Węsierska, A.; Sokołowska, M.M.; Socha, M.; Liczner, G.; Pawlak-Osińska, K.; Wiciński, M. Intermittent fasting in cardiovascular disorders-an overview. *Nutrients* 2019, 11, 673.
11. Paoli, A.; Tinsley, G.; Bianco, A.; Moro, T. The influence of meal frequency and timing on health in humans: The role of fasting. *Nutrients* 2019, 11, 719.
12. Horne, B.D.; Muhlestein, J.B.; Lappe, D.L.; May, H.T.; Carlquist, J.F.; Galenko, O.; Brunisholz, K.D.; Anderson, J.L. Randomized cross-over trial of short-term water-only fasting: Metabolic and cardiovascular consequences. *Nutr. Metab. Cardiovasc. Dis.* 2013, 23, 1050–1057.
13. Powers AC, Niswender KD, Evans-Molina C. Diabetes mellitus: diagnosis, classification, and pathophysiology. In: Jameson JL, Fauci AS, Kasper DL, Hauser SL, Longo DL, Loscalzo J, editors. *Harrison's principles of internal medicine*, 20e. New York: McGraw-Hill Education; 2018.
14. Davies MJ, D'Alessio DA, Fradkin J, et al. Management of Hyperglycaemia in type 2 diabetes, 2018. A consensus Report by the American Diabetes Association (ADA) and the European Association for the Study of diabetes (EASD). *Diabetes Care.* 2018;41(12):2669–701.
15. Kogevinas, M.; Espinosa, A.; Castelló, A.; Gómez-Acebo, I.; Guevara, M.; Martin, V.; Amiano, P.; Alguacil, J.; Peiro, R.; Moreno, V.; et al. Effect of mistimed eating patterns on breast and prostate cancer risk (MCC-Spain Study). *Int. J. Cancer* 2018, 143, 2380–2389.
16. C.R.; Nelson, S.H.; Breen, C.I.; Hartman, S.J.; Natarajan, L.; MarinacPierce, J.P.; Flatt, S.W.; Sears, D.D.; Patterson, R.E. Prolonged Nightly Fasting and Breast Cancer Prognosis. *JAMA Oncol.* 2016, 2, 1049–1055.
17. Srour, B.; Plancoulaine, S.; Andreeva, V.A.; Fassier, P.; Julia, C.; Galan, P.; Hercberg, S.; Deschasaux, M.; Latino-Martel, P.; Touvier, M. Circadian nutritional behaviours and cancer risk: New insights from the NutriNet-santé prospective cohort study: Disclaimers. *Int. J. Cancer* 2018, 143, 2369–2379.
18. Li Sucholeiki, R.; Propst, C.L.; Hong, D.S.; George, G.C. Intermittent fasting and its impact on toxicities, symptoms and quality of life in patients on active cancer treatment. *Cancer Treat. Rev.* 2024, 126, 102725.
19. Papazoglou AS, Moysidis D, V Tsagkaris C, Vouloagkas I, Karagiannidis E, Kartas A et al. Impact of religious fasting on metabolic and hematological profile in both dyslipidemic and non-dyslipidemic fasters. *Eur J Clin Nutr.* (2022) 76:891–8. 10.1038/s41430-021-01053-7

20. Halawa A. Impact of intermittent dietary restriction on the health-related outcomes of faith-based fasting. *J Ethnic Foods*. (2020) 7:14. 10.1186/s42779-020-00047-3
21. Hu D, Xie Z, Ye Y, Bahjri S, Chen M: [The beneficial effects of intermittent fasting: an update on mechanism, and the role of circadian rhythm and gut microbiota](#). *Hepatobiliary Surg Nutr*. 2020, 9:597-602
22. Dong TA, Sandesara PB, Dhindsa DS, et al. *Am J Med*. 2020, 133:901-7. 10.1016/j.amjmed.2020.03.030
23. Jia H. and Lubetkin E. I., Trends in quality-adjusted life-years lost contributed by smoking and obesity, *American Journal of Preventive Medicine*. (2010) 38, no. 2, 138–144, 2-s2.0-73649096563.
24. Crupi, A.N.; Haase, J.; Brandhorst, S.; Longo, V.D. Periodic and Intermittent Fasting in Diabetes and Cardiovascular Disease. *Curr. Diabetes Rep*. 2020, 20, 83.
25. Allison, K.C.; Hopkins, C.M.; Ruggieri, M.; Spaeth, A.M.; Ahima, R.S.; Zhang, Z.; Taylor, D.M.; Goel, N. Prolonged, Controlled Daytime versus Delayed Eating Impacts Weight and Metabolism. *Curr. Biol*. 2021, 31, 650–657.e3.
26. Hutchison, A.T.; Regmi, P.; Manoogian, E.N.C.; Fleischer, J.G.; Wittert, G.A.; Panda, S.; Heilbronn, L.K. Time-Restricted Feeding Improves Glucose Tolerance in Men at Risk for Type 2 Diabetes: A Randomized Crossover Trial. *Obesity* 2019, 27, 724–732.
27. Xie, Z.; Sun, Y.; Ye, Y.; Hu, D.; Zhang, H.; He, Z.; Zhao, H.; Yang, H.; Mao, Y. Randomized Controlled Trial for Time-Restricted Eating in Healthy Volunteers without Obesity. *Nat. Commun*. 2022, 13, 1003.
28. Dong, T.A.; Sandesara, P.B.; Dhindsa, D.S.; Mehta, A.; Arneson, L.C.; Dollar, A.L.; Taub, P.R.; Sperling, L.S. Intermittent Fasting: A Heart Healthy Dietary Pattern? *Am. J. Med*. 2020, 133, 901–907.
29. Koubova J, Guarente L. 2003. How does calorie restriction work? *Genes & Dev*, 17; 313–21
30. Narendran P, Estella E, Furlanos S, Immunology of type 1 diabetes. *Q. J. Med*. 2005; 98: 547–556.
31. MO Kurrer, SV Pakala, HL Hanson, JD Katz, Beta cell apoptosis in T cell-mediated autoimmune diabetes. *Proc Natl Acad Sci USA* 94, 213–218 (1997).
32. Gamble KL, Berry R, Frank SJ, Young ME (2014) Circadian clock control of endocrine factors. *Nat Rev Endocrinol* 10(8):466–475.
33. Cade WT. Diabetes-related microvascular and macrovascular diseases in the physical therapy setting. *Phys Ther*. 2008; 88(11): 1322-1335.
34. Buscemi, C.; Randazzo, C.; Barile, A.M.; Bo, S.; Ponzo, V.; Caldarella, R.; Malavazos, A.E.; Caruso, R.; Colombrita, P.; Lombardo, M.; et al. Factors associated with body weight gain and insulin-resistance: A longitudinal study. *Nutr. Diabetes* 2024, 14, 21. AJ Barnes et al.
35. Wood HG, Lifson N, Lorber V. The position of fixed carbon in glucose from rat liver glycogen. *J Biol Chem* 1945; 159: 475–489.
36. Ceriello A., New insights on oxidative stress and diabetic complications may lead to “casual” antioxidant therapy, *Diabetes Care*. (2003) 26, 1589–1596.
37. Tang, W.H.; Kitai, T.; Hazen, S.L. Gut Microbiota in Cardiovascular Health and Disease. *Circ. Res*. 2017, 120, 1183–1196.
38. Pyke, C.; Knudsen, L.B. The Glucagon-like peptide-1 receptor—Or not? *Endocrinology* 2013, 154, 4–8.
39. Lee M, Whitsel E, Avery C, Hughes TM, Griswold ME, Sedaghat S, et al. Variation in population attributable fraction of dementia associated with potentially modifiable risk factors by race and ethnicity in the US. *JAMA Netw Open*. 2022;5: e2219672.
40. Garcia-Molina L, Lewis-Mikhael A, MRiquelme-Gallego B, Cano-Ibanez N, Oliveras-Lopez M, JBueno-Cavanillas A. Improving type 2 diabetes mellitus glycaemic control through lifestyle modification implementing diet intervention: a systematic review and meta-analysis. *Eur J Nutr*. (2020) 59:1313–28. doi: 10.1007/s00394-019-02147-6.
41. Elleri, D · Allen, JM · Kumareshwaran, K · et al. Closed-loop basal insulin delivery over 36 hours in adolescents with type 1 diabetes: randomized clinical trial *Diabetes Care*. 2013; 36:838-844.
42. Kleinert M, Clemmensen C, Hofmann SM, et al. Animal models of obesity and diabetes mellitus. *Nat Rev* 2018; 14: 140–152.
43. [Effects of 8-hour time restricted feeding on body weight and metabolic disease risk factors in obese adults: A pilot study](#) 2018, Nutrition and Healthy Aging.
44. Bashier, A.; Bin Hussain, A.; Abdelgadir, E.; Alawadi, F.; Sabbour, H.; Chilton, R. Consensus recommendations for management of patients with type 2 diabetes mellitus and cardiovascular diseases. *Diabetol. Metab. Syndr*. 2019, 11, 80.
45. S.H. Saydah, D. Byrd-Holt, M.I. Harris Projected impact of implementing the results of the diabetes prevention program in the U.S. population *Diabetes Care*, 25 (2002), pp. 1940-1945
46. Caverio-Redondo I, et al. Glycated haemoglobin A_{1c} as a risk factor of cardiovascular outcomes and all-cause mortality in diabetic and non-diabetic populations: a systematic review and meta-analysis. *BMJ Open* 2017; 7(7):e015949.
47. Guzik TJ, Cosentino F. Epigenetics and immunometabolism in diabetes and aging. *Antioxid Redox Signal* 2018; 29: 257-274. European Commission DG Health and Consumers (SANCO)

48. Guidelines on a Medical Devices Vigilance System [Internet], 2013.
49. Garber A, Henry RR, Ratner R, Hale P, Chang CT, Bode B. Liraglutide: a once-daily human glucagon-like peptide 1 analogue, provides sustained improvements in glycaemic control and weight for 2 years as monotherapy compared with glimepiride in patients with type 2 diabetes. *Diabetes ObesMetab* 2011; 13(4): 348–356.
50. Steel, J.M.; Young, R.J.; Lloyd, G.G.; Clarke, B.F. Clinically apparent eating disorders in young diabetic women: Associations with painful neuropathy and other complications. *Br. Med. J.* 1987, 294, 859–862.
51. Metzger BE, Lowe LP, Dyer AR, Trimble ER, Chaovarindr U, Coustan DR, Hadden DR, McCance DR, Hod M, McIntyre HD, et al: Hyperglycemia and adverse pregnancy outcomes. *N Engl J Med.* 2008, 358: 1991-2002.
52. Gillies CL, Abrams KR, Lambert PC, et al. Pharmacological and lifestyle interventions to prevent or delay type 2 diabetes in people with impaired glucose tolerance: systematic review and meta-analysis. *BMJ.* 2007;334(7588):299.
53. Westphal, S.The occurrence of diabetic ketoacidosis in non-insulin dependent diabetes and newly diagnosed diabetic adults*Am J Med.* 1996; 101:19-24.
54. Anagnostou K, Turner PJ. Myths, facts and controversies in the diagnosis and management of anaphylaxis. *Archives of disease in childhood.* 2019 Jan 1;104(1):83-90.
55. Zinman, B.; Wanner, C.; Lachin, J.M.; Fitchett, D.; Bluhmki, E.; Hantel, S.; Mattheus, M.; Devins, T.; Johansen, O.E.; Woerle, H.J.; et al. Empagliflozin, Cardiovascular Outcomes, and Mortality in Type 2 Diabetes. *N. Engl. J. Med.* 2015, 373, 2117–2128.
56. Smith JC, Schatz BR. Feasibility of mobile phone-based management of chronic illness. *AMIA AnnuSympProc* 2010;2010:757-761.
57. Expert Panel on Detection, Valuation, and Treatment of High Blood Cholesterol in Adults Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III)*JAMA*, 285 (2001), pp. 2486-249.
58. Buse JB, Caprio S, Cefalu WT, et al. How do we define cure of diabetes? *Diabetes Care.* 2009;32(11):2133.
59. Kristensen K, Ogge LE, Sengpiel V et al (2019) Continuous glucose monitoring in pregnant women with type 1 diabetes: an observational cohort study of 186 pregnancies. *Diabetologia* 62(7):1143–1153.
60. Chung WK, Erion K, Florez JC, et al. Precision medicine in diabetes: a consensus report from the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetologia.* 2020;63(9):1671–93.
61. Saudek CD, Derr RL, Kalyani RR. Assessing glycemia in diabetes using self-monitoring blood glucose and hemoglobinA1c. *JAMA* 2006;295:1688–1697
62. Merlotti C, Morabito A, Pontiroli AE. Prevention of type 2 diabetes: a systematic review and meta-analysis of different intervention strategies. *Diabetes ObesMetab.* 2014;16(8):719-727.Lee SW, Lee JY, Tan CS, Wong CP. Strategies to make Ramadan fasting safer in type 2 diabetics: a systematic review and network meta-analysis of randomized controlled trials and observational studies. *Med (Baltimore).* 2016;95(2):e2457.
63. Church TS, Thompson AM, Katzmarzyk PT, Sui X, Johannsen N, Earnest CP, et al. Metabolic syndrome and diabetes, alone and in combination, as predictors of cardiovascular disease mortality among men. *Diabetes Care.* 2009;32:1289
64. Smith JC, Schatz BR. Feasibility of mobile phone-based management of chronic illness. *AMIA AnnuSympProc* 2010;2010:757-761.
65. National Health Service. Five year forward view 2014 11/11/2014. (accessed May 2017).
66. Atkinson, M.A. · Maclaren, N.K.The pathogenesis of insulin-dependent diabetes mellitus*N Engl J Med.* 1994; 331:1428-1436