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Review Article

Dietary Intervention and Drug Dose Reduction in Diabetes Mellitus: A Comprehensive Literature Review

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ABSTRACT

Approximately 425 million people worldwide currently have diabetes, and by 2045, that figure is predicted to rise to over 629 million. Many patients still have trouble controlling their blood sugar levels despite major advancements in treatment and the requirement to take several drugs for extended periods of time. A plant-based diet dramatically lowers the risk of diabetes, according to numerous scientific studies, effective treatment strategies like drastically altering one's diet and lowering prescription dosages have not yet garnered much attention. This review's objectives are to evaluate methodological quality, establish research goals, and critically synthesize the data on plant-based dietary intervention in conjunction with pharmaceutical de-intensification in type 1 (T1DM) and type 2 diabetes mellitus (T2DM). A comprehensive review of 35 sources (2001-2025), including clinical guidelines, meta-analyses, cohort studies, main intervention trials, along with a recorded T1DM case report, systematic reviews on low glycemic index (GI) diets and medical nutrition therapy, and residential and app-based dietary intervention trials, was among the primary sources. Eighty-four percent of a mixed T1DM/T2DM cohort (n = 55) achieved controlled blood glucose (≤ 250 mg/dL [13.9 mmol/L]) after a 72-hour plant-based intervention, while 100% of T2DM patients achieved complete glycemic control. Fifty-two percent of insulin-dependent individuals attained full pharmacological remission, and 100% of them showed an insulin dose decrease across two separate investigations. After 8 years of insulin dependence, a documented T1DM case achieved complete insulin elimination, with detectable C-peptide and negative glutamic acid decarboxylase (GAD) antibodies post-intervention; the biological basis of this finding warrants further investigation. Over the course of 3 to 12 months, low-GI eating habits lowered HbA1c by 0.3% to 0.9% and high-fiber therapies by 0.26% to 0.55% in T2DM populations. There is strong but preliminary evidence that the integrated plant-based dietary and pharmaceutical de-intensification program is a clinically significant diabetic care approach. To validate these results, rigorous multicenter randomized controlled trials with a minimum 12-month follow-up, independent replication, and thorough biochemical monitoring are desperately needed.

Keywords: Plant-based dietary intervention, glycemic control, pharmacological de-intensification, insulin dose reduction, medical nutrition therapy, type 1 and type 2 diabetes mellitus, beta cell function and diabetes remission, glycemic index and dietary fiber

INTRODUCTION

Background on Diabetes Mellitus

Prevalence and Global Impact of Diabetes

Without a doubt, diabetes mellitus is one of the defining health issues of the 21st century. It affects millions of people across every continent. The International Diabetes Federation reported that around 425 million cases of diabetes were reported globally in 2017 and will stand at 629 million by 2045. [1] India had approximately 72.9 million cases of

diabetes in 2017 alone, ranking among the two or three most diabetes-affected countries worldwide. [1, 2] In 2017, there were 82 million cases in the Southeast Asia region, and the number is predicted to reach 151 million by 2045. [2]

It occurs in two main forms: type 1 diabetes mellitus (T1DM) and type 2 diabetes mellitus (T2DM). T2DM affects most people throughout the globe, accounting for around 90% to 95%. In this type of diabetes, there is progressive insulin resistance, and the ability of beta cells to produce insulin decreases gradually due to lifestyle factors, including diet, physical activity, and body composition. [3] In contrast, T1DM is an autoimmune disorder that destroys the insulin-producing beta cells of the pancreatic islets of Langerhans, resulting in absolute insulin deficiency. It accounts for only about 5% to 10% of all diabetes cases. Although this number is lower than that of type 2, the mental and physical burden it places on patients is enormous. In particular, since the disease is often diagnosed at a young age—in childhood or adolescence—young children are forced to live on insulin for decades. [3, 4] Similarly, there is another type of diabetes called Maturity Onset Diabetes of the Young, which is caused by genetic factors (single-gene mutations). It is found in a very small number of people, accounting for about 1% to 2% of all cases. [5]

When blood sugar levels remain high for a long time, it seriously affects the small and large blood vessels of the body, which not only reduces the average life expectancy of a person, but also makes the rest of their life miserable. For example, the biggest cause of blindness in working-age adults around the world today is “diabetic retinopathy,” which can be prevented if timely preventive measures are taken. Similarly, “diabetic nephropathy” is one of the main causes of complete kidney failure. Peripheral neuropathy causes lifelong pain and numbness, while in severe case could lead to amputation of the lower limbs. [6] Macrovascular disease, including coronary artery disease, cerebrovascular disease, and peripheral arterial disease, is the leading cause of death in diabetic populations. [6] Maintaining proper blood sugar levels is very important in the treatment of every person with diabetes. Because the higher the “HbA1c” (glycated hemoglobin), the main indicator of the long-term state of sugar in the body, the higher the risk of the health problems mentioned above. [7]

India’s specific burden deserves additional attention. Here, approximately 3 per 100,000 children under the age of 14 are newly diagnosed with T1DM every year. Regional statistics are even more alarming; for example, in Karnataka, the prevalence is 17.93 per 100,000, and in Karnal, Haryana, it is 10.2 per 100,000. [2, 8] As of 2015, the number of children with T1DM in India had reached 97,700, and the rate continues to increase by 3% to 5% annually. [8] These already alarming figures are compounded by today’s sedentary lifestyles, changing dietary patterns, and increasing urbanization, which are putting people at risk for both types of diabetes.

Current Treatment Approaches and Their Limitations

The past 30 years have seen significant and positive changes in the drug treatment of diabetes. There are now many options available, especially for patients with T2DM, ranging from the first-line drug metformin to more modern drugs such as sulfonyleureas, dipeptidyl peptidase-4 inhibitors

(DPP-4i), sodium-glucose co-transporter-2 inhibitors (SGLT-2i), glucagon-like peptide-1 receptor agonists (GLP-1 RA), and thiazolidinediones, as well as various types of insulin given by injection, depending on the stage of the disease. [9] Since the discovery of insulin a century ago, the only option for T1DM has been to take insulin externally, which must be delivered into the body through repeated injections every day or through continuous infusion under the skin. [4]

Despite the availability of so many medications, treatment outcomes for most diabetic patients are still unsatisfactory. Many people with T2DM do not achieve their HbA1c target despite taking multiple medications. As the disease progresses, additional medications are required, which are costly and cumbersome, and are associated with adverse effects such as hypoglycemia, weight gain, gastrointestinal problems, and cardiovascular risk. [10] Polypharmacy and drug interactions make treatment management more challenging and financially burdensome, especially in older patients, which in itself is a serious health risk. [10]

The situation for people with T1DM is different, but the challenges are no less. Insulin is life-saving, but it is not perfect; patients must constantly balance between high blood sugar levels (hyperglycemia) and low blood sugar levels (hypoglycemia), as it cannot mimic the delicate balance of insulin that our bodies naturally produce. Conventional treatments have not been able to address the fatigue of injections, the development of fat deposits at the injection site (lipodystrophy), and the mental stress of constantly checking blood sugar and adjusting insulin doses that people with T1DM experience. [4] The conventional view holds that T1DM is irreversible; however, emerging case-level evidence suggests that plant-based dietary intervention may achieve significant insulin dose reduction and improved glycemic control, though these findings require validation in larger studies before any definitive conclusions can be drawn. [11, 12]

Whether diabetes is “cured” or “reversed” is a matter of debate. According to the 2021 consensus report, “remission” is the most appropriate descriptive term, and HbA1c <6.5% (48 mmol/mol) measured at least 3 months after cessation of glucose-lowering pharmacotherapy is the usual diagnostic criterion. [13]

Importance of Dietary Interventions in Diabetes Management

Diabetes management is not just about diet, but it should be an essential and most important part of it. The latest recommendation, released in 2023 by Reynolds and colleagues on behalf of the European Association for the Study of Diabetes (EASD), also emphasizes the same point made by the American Diabetes Association—namely, that “medical nutrition therapy” (MNT) is an indispensable part of the complete treatment of diabetes. [14] The Diabetes and Nutrition Study Group (DNSG) of the European Association for the Study of Diabetes (EASD) has carefully examined the data from various dietary patterns, including low-carb, vegetarian, Mediterranean, and low glycemic index (GI). They concluded that no single diet is best for all patients, but that improvements in diet quality consistently have positive effects on blood sugar levels and heart health. [14] In a comprehensive analysis that was published in *Nature Reviews*

Endocrinology in 2025, Barrea et al. further argued that MNT should be seen as a significant therapeutic modality that is tailored to the patient's needs and culture rather than an adjunct to medication. [15]

There have been many important studies on the role of fruit and vegetable consumption in preventing diabetes and controlling blood sugar levels. The EPIC-Norfolk study conducted by Sargeant and colleagues in the United Kingdom in 2001 showed that people who ate more fruit and vegetables had lower HbA1c levels, an effect that was independent of other dietary or lifestyle factors. [16] Harding et al., in a separate study conducted on the same group in 2008, used vitamin C as a reliable biomarker for fruit and vegetable consumption to examine the relationship between blood levels of vitamin C and the risk of T2DM. Even after adjusting for variables including body mass index, physical activity, and total calorie intake, higher blood levels of vitamin C were associated with a lower risk of developing T2DM. [17]

Since heart disease is the leading cause of death in people with diabetes, eating fruits and vegetables plays a major role not only in controlling blood sugar but also in protecting the heart. A large study conducted by Joshipura et al. in 2001 on >126,000 health workers showed that people who eat a lot of fruits and vegetables have a significantly lower risk of developing coronary heart disease. [18] Alemu has provided an in-depth analysis of how the antioxidants, anti-inflammatory properties, micronutrients, and phytochemicals found in fruits and vegetables benefit overall human health, beyond blood sugar control and heart protection. [19] A study by Gomes-Neto and colleagues found that kidney transplant recipients who ate more fruit and vegetables were significantly less likely to develop post-transplant diabetes. [20]

The concepts of the GI and glycemic load (GL) explain how blood sugar levels rise after eating food. In 2011, Marsh et al. reviewed data from several trials and found that eating low-GI foods significantly reduced HbA1c and fasting blood sugar levels in both T1DM and T2DM. [21] This was confirmed again in 2024 by Gerontiti et al., who found that HbA1c levels in T2DM decreased by 0.3% to 0.9%, and their cholesterol levels and heart health also improved. [22]

The China Study, conducted by Campbell and Campbell in 2005, is considered the most comprehensive and in-depth study of nutrition to date. The study found that eating a high amount of animal-derived foods, such as meat and dairy products, significantly increased the risk of developing complex health problems such as diabetes, heart disease, and cancer. [23] On the other hand, people who eat a natural plant-based diet have been found to have a much lower risk of these diseases. [23]

One of the most popular and important aspects of a plant-based diet for diabetes is dietary fiber. In 2024, Nitzke et al. reviewed 17 different studies and found that increasing dietary fiber intake significantly improved both fasting glucose and HbA1c. [24] In addition to nutritional considerations, the impact of our eating habits and mental state on diabetes management is also important. In 2006, Yannakoulia pointed out that the main reasons why people give up dieting are not only a lack of knowledge, but also emotional eating, fear of losing taste in food, and social or cultural pressure. [25]

Rationale for the Study

Need for Improved Treatment Protocols

The current drug-based treatment regimen for diabetes control has some serious shortcomings, such as requiring multiple medications rather than a single drug, which does not control blood sugar levels for a long time, increasing the side effects of the drugs, and not paying attention to diet and metabolism, which are considered the main root causes of the disease. [10, 15] Therefore, the need for more effective and reliable treatment methods has become very urgent.

The evidence presented in this article makes it clear that, when combined with a scientifically sound, supervised, and systematic approach to reducing medication, a plant-based diet provides a powerful and effective alternative to the traditional approach of adding medication alone. [12, 26, 27] A study by Chowdhury in 2017 [26] of 55 patients with both T1DM and T2DM found that 84% of them had their blood sugar under control after 72 hours of modifying their diet, while a 2019 study of 53 individuals using an app indicated that all patients were able to fully wean themselves off insulin. Notably, the documented T1DM case represents an early report of complete insulin elimination in a long-standing T1DM patient, though the authors caution that this single case cannot be generalized and independent replication is essential. [11, 12, 26, 27]

Potential Benefits of Combining Dietary Intervention With Dose Reduction

Improving your diet and adjusting your medication are both important for your body and can be done together. A balanced diet reduces your body's insulin requirements and helps keep your blood sugar levels in balance, but continuing to take your medication at the same dose can lead to a sudden drop in blood sugar (hypoglycemia). On the other hand, simply reducing your medication without changing your diet can cause your blood sugar to rise uncontrollably. Therefore, combining these two approaches, guided by clear clinical thresholds and regular blood sugar monitoring, is the safest and most practical way to treat diabetes. [27, 28]

The scientific basis for this strategy is derived from the 2018 American College of Physicians (ACP) recommendations, which Chowdhury made more practical by comparing them to a specific blood sugar level (threshold) in 2019. [28] According to these guidelines, if a patient's average blood sugar (average of fasting and 2-hour postprandial) is less than 170 mg/dL (9.4 mmol/L), then the dose of diabetes medication can be reduced. [28]

Gaps in Current Research Addressing This Approach

Although several large studies (EPIC-Norfolk, The China Study, Nurses' Health Study) [16-18, 23] and scientific evidence [15, 21, 22, 24, 29], along with clinical results from Chowdhury [26, 27], have shown the same thing, this integrated approach to reducing food and medication intake has not yet been the subject of a solid and formal investigation. Such major studies to date have not included a control group, nor have they been scientifically selected (randomized); there is also a lack of long-term follow-up or in-depth statistical analysis. The results of completely reversing T1DM have not yet been confirmed by other independent bodies. Not only this, there has not yet been

a systematic study of how much this method reduces the cost of treatment or how much the patient's quality of life has improved.

The European recommendations issued by the Diabetes and Nutrition Study Group (DNSG) of the European Association for the Study of Diabetes (EASD) in 2023 acknowledge the growing importance of plant-based diets in diabetes management, but do not fully endorse a strict "diet reversal" approach. [14] They point out that there is still a need for more robust evidence on the sustainability of this approach, its safety in different populations, and its long-term outcomes.

Objectives of the Study

Primary Aim of the Review

The main objective of this study is to provide an in-depth analysis of plant-based dietary and drug-reduction techniques for the treatment of T1DM and T2DM, focusing on the specific methods developed by Chowdhury and his colleagues.

Specific Goals of the Review

The specific objectives of this review are: (1) critically evaluate the study designs, participant profiles, dietary protocols, and dose reduction methodologies used in the reviewed primary intervention studies; (2) synthesize the reported clinical and biochemical outcomes, including changes in blood glucose, HbA1c, medication requirements, body weight, blood pressure, and lipid profiles; (3) analyze the evidence on fruit and vegetable intake and glycemic outcomes from population-based studies; and (4) to identify the key research gaps and propose a structured agenda for future investigation.

Expected Outcomes and Broader Significance

If the integrated approach of diet and medication discussed here can be validated in future rigorous and systematic trials, its impact on diabetes management worldwide would be enormous. Controlling blood sugar levels with such a natural approach that is inexpensive, has no adverse effects, and is consistent with established nutritional science—and in some cases, eliminates medication—could be a revolutionary change in diabetes treatment. This is especially important for low- and middle-income countries, where access to medication and high cost are major barriers to treatment. [26, 27, 30]

MATERIALS AND METHODS

Study Design

Types of Study Designs Reported in the Literature

The pre-post interventional study, in which participants act as their own controls and clinical parameters are evaluated before and after a specified dietary intervention, is the most often reported design in the research examined here. Using this design, Chowdhury carried out one of the first organized plant-based dietary trials in India. It was a 3-day residential trial with 55 diabetic patients (21 T1DM and 34 T2DM). [26] In larger app-based research with 53 patients, a six-person medical team remotely observed participants for 72 hours and recorded insulin and drug reduction outcomes in real time using a similar approach. [27] Rare outcomes, such as the first recorded case of complete insulin elimination in T1DM by dietary intervention alone, have also been documented using case study approaches. [11, 12]

Randomized controlled trial designs with follow-up periods ranging from 6 months to 5 years have been the mainstay of long-term dietary intervention research in diabetes. HbA1c, fasting glucose, and postprandial glucose were significantly reduced in both T1DM and T2DM populations, according to Marsh et al., who synthesized data from several randomized controlled trial (RCTs) looking at low GI and low GL dietary treatments. [21] A recent systematic review by Gerontiti et al. in 2024 confirmed this. [22] Similarly, Nitzke et al., analyzing 17 different studies, found that a fiber-based treatment in T2DM consistently improved fasting glucose and HbA1c. [24]

The near-complete absence of well-designed RCTs investigating the combined effect of plant-based dietary intervention and organized pharmaceutical dose reduction as a contemporaneous, integrated strategy is a crucial methodological gap that this study highlights.

Study Durations Reported in the Literature

The evaluated literature covers a wide variety of study lengths, from 72 hours to several years. Several trials have duplicated the 3-day intensive dietary intervention strategy created by Chowdhury and colleagues, and it seems to be very successful in obtaining a quick initial decrease in blood glucose and medication needs. [26, 27] The sustainability of diet-induced glycemic improvements and their effects on HbA1c are demonstrated by medium-term trials lasting 3 to 12 months, such as those examined by Gerontiti et al. and Barrea et al. [15, 22]

Ethical Frameworks Referenced

Different levels of ethical monitoring are shown in the evaluated studies. Participant consent and institutional review procedures are reported in the bigger, peer-reviewed studies. The use of standardized consent and medication forms, participant disclosure of clinical history, and continuous monitoring by a trained medical team are all described in Chowdhury's investigations. [26, 27] Case study publications follow the publication ethical rules of the relevant journals and acknowledge the patient's informed participation. [11, 12]

Participant Selection and Recruitment

Inclusion and Exclusion Criteria in Reviewed Studies

The plant-based dietary intervention studies by Chowdhury and colleagues deliberately recruited heterogeneous populations, including T1DM and T2DM patients, insulin-dependent and non-insulin-dependent individuals, patients with disease durations ranging from 28 days to 22 years, and age groups as young as 5 years to as old as 66 years. [26, 27] Patients with a range of medical ailments, such as high blood pressure, thyroid issues, cholesterol issues, gastrointestinal issues, kidney stones, pancreatitis, and heart disease, were also included in the reviewed studies. [27] Nevertheless, there are no explicit guidelines that specify which patients should not be included in the study (exclusion criteria).

In general, studies examined by Barrea et al. and Gerontiti et al. used stricter inclusion criteria, eliminating those with significant renal or hepatic impairment, including only T2DM patients with a proven diagnosis in accordance with American Diabetes Association (ADA) standards, and occasionally limiting age ranges. [15, 22]

Sample Sizes in the Literature

By the standards of traditional clinical trials, sample sizes in the examined literature are modest. 55 individuals were enrolled in Chowdhury's trial; 53 patients were enrolled in the app-based study that followed. [26, 27] Single patients were included in the T1DM case studies. [11, 12] Individual included trials in the systematic reviews and meta-analyses frequently had sample sizes between 30 and 200 participants. [21, 22, 24]

Recruitment Methods

The use of a specialized mobile application, the Diabetes72 app, as a recruitment and real-time monitoring platform is one of Chowdhury's most inventive methodological contributions. [26, 27] This made it possible to enroll people from all around India and other nations. This method does, however, bring significant biases: individuals who self-select into a digital intervention study may have different computer literacy, health motivation, socioeconomic position, and baseline health behaviors than the general diabetes population.

Dietary Intervention Protocol

Overview of Dietary Protocols in the Literature

For 72 hours, Chowdhury and his colleagues' strictest routine calls for consuming only raw fruits, raw vegetables, coconut water, almonds, and sprouted grains. Dairy products, packaged foods, and non-vegetarian foods are totally avoided. [12, 26, 27] The quantities prescribed are individualized by body weight—for instance, it is advised to consume 5 g of vegetables multiplied by one's weight for lunch and supper, and 10 g of fruit multiplied by one's weight for breakfast (e.g., 700 g for a 70 kg body weight). [26] In addition to food, it highlights additional lifestyle factors for controlling blood sugar, such as sun exposure in the morning and mild exercise (such as walking and pranayama).

The basic intervention phase, a less restrictive version, consists of cooked food in addition to raw ingredients and is meant to be used as a preparatory phase before intense intervention or for home-based maintenance after the intensive phase. [11, 12]

In contrast, a wider variety of techniques is covered by the dietary regimens evaluated in Barrea et al. and Gerontiti et al., such as Mediterranean diets, low-carb diets, very-low-calorie diets, and low-GI dietary patterns. [15, 22]

Nutritional Composition and Scientific Rationale

Low-GI diets lower HbA1c by about 0.5% and improve fasting glucose in both T1DM and T2DM patients, according to Marsh et al. [21] These benefits are explained by low-GI meals' slower rate of glucose absorption and carbohydrate digestion, which lessens the amplitude of postprandial glucose excursions and, as a result, lowers insulin demand. [21, 22]

Dietary fiber is another important factor in blood sugar regulation. Nitzke et al. evaluated 17 trials in 2024 and found that increasing soluble fiber consistently improved fasting blood sugar and HbA1c in individuals with T2DM. [24] It functions by slowing the pace at which sugar is taken into the blood following a meal, decreasing the amount of sugar produced by the liver, and delaying the stomach's emptying.

Additionally, fiber is broken down by beneficial bacteria in the stomach to produce short-chain fatty acids (SCFAs), which improve the body's sensitivity to insulin. [24]

Another unique aspect of the Chowdhury regimen is the elimination of animal-derived food, especially dairy. The China Study by Campbell and Campbell raised awareness of the link between eating animal proteins, especially casein from milk, and the development of autoimmune reactions that could kill pancreatic beta cells. [23] The reviewed research also supports the idea that dietary advanced glycation end products (AGEs), which are created during the processing and cooking of meat, contribute to insulin resistance and systemic inflammation in T2DM. [26] The macronutrient profile of plant-predominant diets is generally consistent with established targets for cardiometabolic risk management in patients with diabetes. [29]

Monitoring of Dietary Adherence in the Literature

Because participants had no access to non-protocol foods during the 72-hour intense phase, Chowdhury's residential approach effectively reduces adherence uncertainty. [26] Daily Dietary Adherence Monitoring (DAM) form submissions and immediate conversations with the medical analyst team were used to track adherence in the app-based trial. [27] This method depends on self-reporting, which is vulnerable to social desirability bias.

Dose Reduction Methodology in the Literature

Medications Addressed in the Reviewed Studies

The examined research shows dose decrease in a wide range of antidiabetic medications: Actrapid, NovoRapid, Humalog, long-acting insulins (Lantus, Tresiba), premixed formulations (Mixtard, Wosulin, Biphasic Human), and a variety of oral medications, such as metformin, sulfonylureas (glimepiride, gliclazide), DPP-4 inhibitors (teneligliptin, sitagliptin), SGLT-2 inhibitors (dapagliflozin), pioglitazone, and acarbose. [27]

Criteria and Frameworks for Dose Reduction

Chowdhury's most important technical contribution was the development and application of a scientific method for reducing the dose of medication based on the average level of blood sugar. Based on the average sugar (which is calculated by adding the readings on an empty stomach and at bedtime—2 hours after eating dinner), this method divides patients into four groups: if the sugar is less than 150 mg/dL, the dose of medication is reduced by 10%; if the sugar is 150 to 250 mg/dL, the previous dose is continued; if it reaches 250 mg/dL, it is increased by 10%; and if it exceeds 300 mg/dL, it is increased by 20% (**Table 1**).

The ACP Guidelines (2018), which Chowdhury converted into blood glucose equivalents using the Diabetes Control and Complications Trial (DCCT)-derived formula: average blood glucose (mg/dL) = (35.6 times HbA1c) - 77.3 [35], provide the scientific basis for the 250 mg/dL criterion. [28] The ACP specifically advises de-intensifying pharmaceutical therapy when HbA1c is less than 6.5%, which is equivalent to roughly 155 mg/dL (8.6 mmol/L) venous or 170 mg/dL (9.4 mmol/L) capillary. [28]

Table 1: Summary of dose adjustment algorithm based on average blood glucose (Chowdhury et al., 2019).^[27]

Average blood glucose (mg/dL)	Clinical interpretation	Dose adjustment	Recommended action
<150	Over-controlled; hypoglycemia risk	Reduce by 10%	Taper medication
150–250	Controlled; safe range	Maintain current dose	Continue monitoring
250–300	Borderline; early hyperglycemia	Increase by 10%	Reassess diet adherence
>300	Uncontrolled hyperglycemia	Increase by 20%	Repeat assessment cycle
≤170 (while on medication)	ACP de-intensification threshold	Begin stepwise reduction	Reduce toward nil if sustained

However, it should be noted that this drug reduction algorithm has not been scientifically validated in the research to date with any comparison group (**Figure 1**).

Data Collection and Outcome Measures in the Literature

Primary and Secondary Outcomes Reported

Reductions in blood glucose (both fasting and postprandial) and a decrease in the need for medication are the main results reported in all of the analyzed trials. Chowdhury used a post-prandial threshold of ≤250 mg/dL (13.9 mmol/L) to identify “controlled” and “partially controlled” blood glucose as the main outcome groups. [26] The 2019 study defined partially managed glycaemia as reaching the same threshold with less than 50% of the previously prescribed insulin, and controlled glycaemia as blood glucose ≤250 mg/dL (13.9 mmol/L) without any medication. [27]

Reduction of body weight, normalization of blood pressure, and alleviation of comorbid disorders are examples of secondary outcomes reported in this research. Over 3 days, Chowdhury reported an average weight loss of 1.14 kg per participant; the 2019 study revealed an average reduction of 1.68 kg. [26, 27]

Biochemical indicators such as HbA1c, C-peptide, and GAD antibody levels were monitored as outcome measures in the T1DM case studies. [11, 12] The patient’s C-peptide level of 0.93 ng/mL and GAD antibody level of 7 U/mL (less than 30 U/mL was deemed negative) were reported. [11] According to the ADA/EASD consensus, patients with T1DM typically have C-peptide <0.6 ng/mL after 5 years from diagnosis. [13]

Assessment Tools for Glycemic Parameters

Standard portable glucometers were used for blood glucose monitoring in the analyzed trials, and capillary blood was drawn from the tip of the finger. The main glycemic metric was the average of the readings obtained at two standard time points: fasting (before breakfast) and 2 hours after dinner. [27, 28] Continuous glucose monitoring (CGM) systems were not used in the primary studies reviewed. Due to the short 3-day intervention window, HbA1c measurement was not consistently followed in all examined investigations. [21] The T1DM case study is an exception, where HbA1c decreased from 9.3% at diagnosis to 7.2% post-intervention about 6 weeks later (**Table 2**). [11]

DISCUSSION

Interpretation of Key Findings

Summary and Meaning of the Main Results

A structured, supervised plant-based dietary intervention combined with real-time pharmacological dose reduction

guided by blood glucose monitoring appears capable of achieving rapid and significant glycemic control in a broad population of diabetic patients, including those with long-standing disease, multiple comorbidities, and full insulin dependency. This result is supported at the individual level by the documented case of complete insulin elimination in T1DM [11, 12] and at the population level by systematic review evidence confirming the glycemic benefits of low-GI, high-fiber, plant-predominant dietary patterns. It is also consistent across two independent primary intervention studies involving a total of 108 patients. [26, 27]

The speed and extent of the observed effects distinguish the major intervention studies from the larger body of dietary literature. The standard diabetes management literature would not have predicted that 84% to 100% of a mixed diabetic population would achieve controlled blood glucose within 72 hours. According to Gerontiti et al. and Marsh et al., the usual expectation from dietary intervention trials is a slow, modest reduction in HbA1c over months, on the order of 0.3 to 0.9 percentage points. [21, 22]

The documented T1DM case—in which complete insulin elimination was achieved—is the most clinically intriguing finding in the reviewed literature. It does not prove that T1DM is reversible; a single case study cannot do that. However, this case raises an important scientific question: might plant-based dietary intervention achieve meaningful, sustained insulin reduction—and in exceptional circumstances, insulin elimination—in some T1DM patients? The post-intervention GAD antibody value of 7 U/mL (well below the negative threshold of 30 U/mL) and the detectable C-peptide of 0.93 ng/mL indicate reduced autoimmune activity and preserved or partially restored beta cell function. These biomarkers merit substantial scientific investigation and replication.

Comparison With Existing Literature

Plant-based and low-GI dietary patterns are beneficial for managing diabetes in the scientific literature. [15, 21–24] However, the mainstream diabetes management literature has long maintained that T1DM cannot be cured through lifestyle changes and has treated dietary modification as an adjunct to pharmacotherapy rather than a replacement for it.

Rejecting these results solely on the basis of methodology would be intellectually dishonest. The effect sizes are substantial—much greater than what would be predicted from random fluctuation or placebo effects. Two separate experiments with distinct participant populations yield consistent results. A biologically sound theoretical framework based on thresholds obtained from ACP guidelines supports the dosage reduction results. [28] The honest conclusion is that the data is very suggestive but not yet conclusive, and

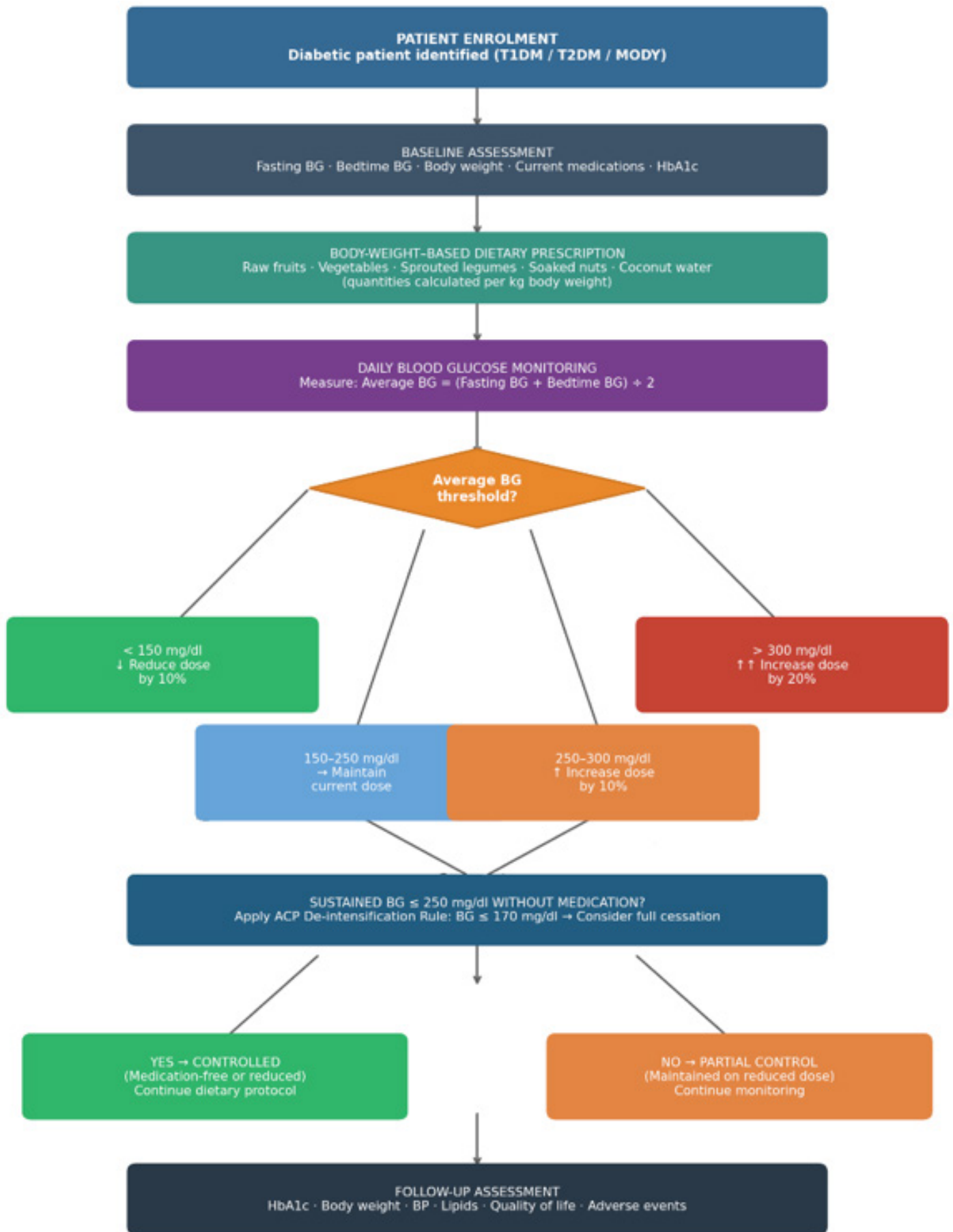


Figure 1: Integrated plant-based dietary intervention and pharmacological dose reduction protocol–flow diagram.

Table 2: Summary of glycemic outcomes reported across key reviewed studies.

Study	Duration	Key glycemic finding	Medication outcome
Chowdhury [26]	3 days	84% achieved BG \leq 250 mg/dL (13.9 mmol/L) off all medication	100% T2DM controlled; 57% T1DM fully controlled
Chowdhury [27]	3 days	Mean BG: $160 \pm 87 \rightarrow 160 \pm 76$ mg/dL	100% insulin reduction; 52% off all medication
Chowdhury [11]	5 months + 3 days	BG: 184 ± 9 mg/dL without insulin	Complete elimination of insulin (60U \rightarrow 0U)
Marsh et al. [21]	Varied (RCTs)	HbA1c \downarrow ~0.5%; fasting blood glucose (FBG) \downarrow 0.7 mmol/L	Not reported as a primary outcome
Gerontiti et al. [22]	3–12 months	HbA1c \downarrow 0.3%–0.9% vs. control diet	Not the focus; indirect reductions noted
Nitzke et al. [24]	4–52 weeks	HbA1c \downarrow 0.26%–0.55%; FBG \downarrow 8–15 mg/dL	Not specifically addressed

that thorough follow-up research rather than dismissal is the proper course of action.

Potential Mechanisms Underlying the Observed Effects

Reduction in Glycemic Load and Insulin Demand

The most direct mechanism is the significant decrease in dietary glycemic load that results from substituting fresh fruits and vegetables for all processed meals, cooked grains, and refined carbohydrates. [21, 26]

Dietary Fiber and Gut Microbiome Effects

This plant-based diet is very high in fiber, which stimulates the gut microbiota to produce SCFAs. Scientific research has shown that these fatty acids improve insulin function, inhibit the production of glucose by the liver, and increase the level of GLP-1. [24]

Elimination of Dietary Triggers of Inflammation and Autoimmunity

Eliminating cow's milk proteins from the diet, especially casein, may lessen the autoimmune antigenic stimulation that causes beta cell death in T1DM according to the molecular mimicry concept. [23, 26] Another pro-inflammatory stimulus is eliminated by removing AGEs from cooked and processed meats. [26]

Sunlight, Vitamin D, and Immune Modulation

An interesting aspect of this diet plan is the recommendation for regular morning sunlight exposure. Several scientific studies have linked vitamin D deficiency to the risk of both T1DM and T2DM. [31–33] In addition, vitamin D helps to balance the body's immune system; for example, it controls the cells that destroy the "beta cells" of the pancreas in T1DM. [31] However, research to date has not clearly measured the patients' vitamin D levels or how much time they spent in the sun.

Rapid Weight and Fluid Reduction

The two main trials' average weight loss of 1.14 to 1.68 kg over 3 days [26, 27] may be partially due to fluid loss, but it may also hasten improvements in insulin sensitivity. In patients with T2DM, even modest weight loss—particularly

in the visceral compartment—is associated with measurable improvements in insulin receptor sensitivity. [34]

Clinical Implications

Potential for Implementation in Routine Diabetes Care

If the results presented here are validated by thorough follow-up studies, the management of T2DM would have the most immediate and practically significant impact. The current standard of care entails a sequential escalation of pharmacotherapy. [9] An alternative paradigm is suggested by the reviewed evidence: pharmacological de-escalation rather than escalation may be possible with an intensive, short-term dietary intervention. The ACP recommendations themselves advise de-intensification of medication when HbA1c drops below 6.5%. However, physicians hardly ever put this advice into practice, in part because they don't have a workable framework for doing so safely. [28] Such a framework is exemplified by the dose reduction algorithm discussed here.

The clinical implications for T1DM are more cautious. The general advice that T1DM patients try to stop taking insulin through diet is not supported by the examined case study evidence; insulin withdrawal in T1DM patients without intensive medical supervision carries significant and potentially fatal hazards. The findings do support a research agenda that examines the biological mechanisms behind the potential for significant insulin decrease in T1DM with supervised dietary intervention.

Cost-Effectiveness of the Proposed Approach

The evaluated intervention's potential cost-effectiveness is one of its most persuasive yet understudied aspects. In India alone, direct medical expenses for managing diabetes are estimated to be in the billions of dollars each year. [1, 2] Considerable cost savings could result from a dietary intervention that eliminates or significantly reduces pharmaceutical requirements. Fresh fruits, raw vegetables, nuts, and sprouts make up the majority of the dietary regimen itself. These foods are far less expensive than the medication they may replace in most low- and middle-income countries, including India. Additionally, the app-based monitoring platform provides an affordable, scalable distribution method. [27]

Future Research Directions

Unanswered Questions and Priority Areas for Investigation

Does the combined dietary and dose reduction protocol produce superior outcomes compared to either intervention alone? As of yet, no research has contrasted the combination strategy with a control arm that just used diet or dosage reduction. A three-arm RCT would be the ultimate design.

Are the short-term glycemic gains durable over 6 to 12 months and beyond? The evidence that has been reviewed shows what can be accomplished in 72 hours. A prospective study with systematic follow-up at these time points is crucial.

What are the biological mechanisms driving the observed outcomes? The molecular level routes proposed in this review remain unproven. Mechanistic sub-studies would further strengthen the evidence base.

How do outcomes vary across different cultural, socioeconomic, and geographic contexts? The majority of the examined primary studies were carried out in an Indian setting. Replication in a variety of geographical contexts is needed.

Potential for Long-Term Studies

The evaluated literature constitutes the first generation of studies on this subject. There is already enough preliminary data to support a fully funded, multicenter, randomized controlled study with long-term follow-up. A trial of this kind should ideally be registered prospectively on a public clinical trial registry, have parallel arms, have a minimum follow-up of 12 months with assessments at 3, 6, and 12 months, and pre-specify all primary and secondary outcomes. The proportion attaining complete pharmacological remission (as defined by the 2021 consensus report [13]), changes in total daily medication dose, body weight, blood pressure, lipid profile, quality of life scores, and incidence of adverse events should be the primary outcome (Table 3).

CONCLUSIONS

Plant-based dietary intervention, when paired with real-time pharmacological dose reduction and continuous glucose monitoring, is a physiologically sound and clinically promising approach to managing both T1DM and T2DM, according to the evidence reviewed in this article.

Higher consumption of fruits and vegetables is strongly and inversely correlated with glycemic risk at the epidemiological level in several sizable prospective cohorts. Mechanistically, low-GI, high-fiber, plant-based diets consistently lower HbA1c. At the clinical level, Chowdhury and colleagues reported 100% insulin dose reduction in all insulin-dependent participants, controlled glycaemia in 84% of mixed T1DM/T2DM patients within 72 hours, and a documented case of total insulin elimination in a T1DM patient with an 8-year insulin dependency.

The basic logic of the integrated protocol is simple: real-time monitoring closes the feedback loop; diet lowers insulin demand; and dose reduction prevents pharmacological excess in the face of that decreased demand. Every component is dependent upon every other component.

This body of evidence's primary drawback is still its methodological immaturity: it lacks quality-of-life data, independent replication, long-term follow-up, validated dose reduction algorithms, and randomized controlled trials. These are specific study goals, not grounds for rejection. A multicenter RCT with a minimum 12-month follow-up, distinct T1DM and T2DM strata, thorough biochemical monitoring, validated quality-of-life tools, and independent replication by researchers not connected to the original study team are required.

The wider impact is a paradigm shift from a reactive, pharmaceutical escalation model to a proactive, diet-first framework. Dietary remission of T2DM is no longer considered fringe science, as demonstrated by the DiRECT experiment. The tentative extension to meaningful insulin reduction in T1DM, while requiring much more robust evidence, represents a scientifically important hypothesis worthy of rigorous investigation.

Table 3: Summary of key research gaps identified in the reviewed literature.

Research gap	Why it matters	Suggested study design
No RCT with a control arm for combined diet + dose reduction	Cannot attribute outcomes to intervention vs. other factors	3-arm RCT: combined vs. diet-only vs. standard care
No long-term follow-up (>3 months) in primary studies	Durability of glycemic remission is unknown	Prospective cohort with 12-month structured follow-up
T1DM reversal not replicated beyond a single case	Cannot distinguish a reproducible phenomenon from an outlier	T1DM-specific case series (n = 20-30) with full biochemical workup
Mechanisms of action have not been formally studied	Without mechanistic clarity, protocol optimization is impossible	Mechanistic sub-studies: microbiome, SCFAs, immunological markers
No formal quality of life measurement	Patient-centered outcomes are entirely missing from evidence-based	Include validated QoL instruments (DQOL, EQ-5D-5L) in future trials
No health economic analysis	The cost-effectiveness case for the intervention has not been established	Cost-utility analysis alongside a future RCT
All primary studies from a single research group	Independent replication needed to rule out allegiance bias	Multicenter trial with independent co-investigators
No personalized dietary adaptation	Individual glycemic variability may limit uniform protocol effectiveness	Precision nutrition sub-study with CGM and microbiome profiling

Table 4: Summary assessment of the evidence base—strength, gaps, and research priorities.

Domain	Current state of evidence	Priority research action
Epidemiological foundation (fruit/veg and glycemia)	Strong—multiple large prospective cohorts [16–20]	No further fundamental epidemiological work needed; proceed to mechanism and trial
Mechanistic evidence (GI, fiber, gut microbiome)	Well-established in T2DM; mechanistic data for T1DM are very limited [21, 22, 24]	T1DM-specific mechanistic studies; microbiome and immunological profiling
Clinical guideline endorsement of MNT	Strong endorsement for T2DM; cautious for intensive protocols [14, 15]	RCT evidence needed to upgrade guideline recommendation strength
Short-term clinical intervention outcomes (72 hours)	Highly promising; consistent across two studies [26, 27]	Independent replication; control group; formal inferential statistics
Long-term durability of glycemic remission	Essentially absent from the primary literature	Prospective 12-month RCT with structured follow-up at 3, 6, and 12 months
T1DM reversal evidence	Single case study; extraordinary but unconfirmed [11, 12]	Case series (n = 20–30); serial GAD, C-peptide, HbA1c over 12 months
Dose reduction algorithm validation	Logically derived; never formally validated [28]	Prospective validation against pharmacokinetic and clinical outcomes
Quality of life measurement	Absent from primary intervention studies [25]	Include Diabetes Quality of Life (DQOL) and EuroQol Five Dimension Five Level (EQ-5D-5L) as co-primary outcomes in future trials
Health economic analysis	No published analysis exists	Cost-utility analysis embedded in future RCT
Independent replication	All primary clinical research from one research group	Multicenter trial with independent co-investigators across geographies

Given that there are currently over 425 million individuals with diabetes and that number is expected to rise to over 600 million by 2045, the scientific community has a duty and an opportunity to thoroughly investigate this area (**Table 4**).

AUTHORS' CONTRIBUTION

All authors have significantly contributed to the work, whether by conducting literature searches, drafting, revising, or critically reviewing the article. They have given their final approval of the version to be published, have agreed with the journal to which the article has been submitted, and agree to be accountable for all aspects of the work.

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CONFLICT OF INTEREST

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