Buletin Kedokteran & Kesehatan Prima
Vol.4 No.1 (2025)
DOI: 10.34012/bkkp.v4i1.6790

ORIGINAL ARTICLE

Impact of high glycaemic index food consumption in patients with type 2 diabetes mellitus: A narrative review

Muhammad Akbar Haris[1], Naufal[1], Victor Trismanjaya Hulu[2]*, Widya Yanti Sihotang[2]

ABSTRACT

Consumption of foods with a high glycaemic index (GI) in patients with type 2 diabetes mellitus (T2DM) can negatively impact their glycaemic control. High-GI foods typically induce a rapid increase in blood glucose levels. This research aimed to identify the impact of high glycaemic index food consumption in individuals with T2DM. A narrative review methodology was employed. The inclusion criteria for this study were articles published in indexed journal databases (Google Scholar, ScienceDirect, Scopus Journal, PubMed, ProQuest) written in English, with cross-sectional and experimental designs. Nine articles published between 2008 and 2025 met the inclusion criteria. The findings of this review underscore the importance of understanding glycaemic index food consumption in patients with T2DM. Integrating low-GI foods into the diet of individuals with T2DM may represent a practical strategy for improving metabolic control and reducing the risk of hyperglycaemia. Improved glycaemic control, such as that achieved by consuming a very-low-carbohydrate, high-fat breakfast, substantially reduces postprandial (after-meal) glucose excursions, particularly in the morning, a period when individuals with type 2 diabetes frequently experience the highest blood glucose spikes. In conclusion, improved glycaemic control, such as that achieved by consuming a very-low-carbohydrate, high-fat breakfast, substantially reduces postprandial (after-meal) glucose excursions, particularly in the morning, a period when individuals with type 2 diabetes frequently experience the highest blood glucose spikes.

Keywords: high glycemic index, type 2 diabetes, narrative review

Introduction

The escalating incidence of diabetes mellitus and its significant implications for the cardiovascular system has become a global health concern. The prevalence of diabetes has surged from 108 million in 1980 to 536.6 million in 2021, with the most rapid increase observed in low- and middle-income countries (World Health Organization [WHO], 2016; Magliano & Boyko, 2021). Poorly controlled diabetes mellitus can lead to long-term complications such as retinopathy, nephropathy, neuropathy, and cardiovascular disease, as well as an [1] elevated risk of mortality. Notably, 43% of deaths attributable to high blood glucose occur prematurely, particularly between the ages of 20 and 69 years (WHO, 2016). Complications of the metabolic

Affiliation
[1]Undergraduate Programme in Public Health, Universitas Prima Indonesia, Medan, Indonesia
[2]Department of Public Health, Universitas Prima Indonesia, Medan, Indonesia

*Corespondence:
vic.trisja@gmail.com

disorder known as type 2 diabetes mellitus (T2DM), including renal failure, amputation, cardiovascular diseases, and cerebrovascular events, can result in high rates of morbidity and mortality (Li et al., 2020).

Globally, approximately 1.5 million deaths occur annually due to diabetes, affecting 422 million individuals worldwide living with the condition. This disease is most prevalent in low- and middle-income countries (WHO, 2024). Data from the International Diabetes Federation (IDF) reported that in 2021, 536.6 million people (10.5% of the total population) had type 2 diabetes. By 2045, this figure is projected to reach 783.2 million (12.2% of the total population). Urban areas are predicted to have a higher prevalence (12.1%) compared to rural areas (8.3%), while high-income countries (11.1%) exhibit a greater prevalence than low-income countries (5.5%) (Sun et al., 2022).

Foods that elicit a high blood glucose response and increase insulin demand are known as high glycaemic index (GI) carbohydrates, and consequently, may elevate the risk of type 2 diabetes. Insulin resistance, largely determined by obesity, physical inactivity, heredity, and other dietary factors, influences an individual's response to specific carbohydrate loads. Therefore, it can be hypothesised that the adverse metabolic effects of high-GI foods will be exacerbated in individuals who are sedentary, overweight, or genetically predisposed (Willett et al., 2002).

High-GI foods not only rapidly elevate blood glucose but also the postprandial insulin response (Chang et al., 2012). Prolonged consumption of diets with a high glycaemic index and glycaemic load can have implications for metabolism and health. These implications may include chronic hyperglycaemia and hyperinsulinaemia, both of which can contribute to insulin resistance and diabetes (Becky & Stanley, 2017). Research involving populations in China and the United States suggests that women with higher dietary intake of high-glycaemic index foods are at a greater risk of developing type 2 diabetes compared to women consuming low-glycaemic index diets (Villegas et al., 2007; Becky & Stanley, 2017; Krishnan, 2007).

Effective glycaemic control is crucial for mitigating diabetic complications, including retinopathy, neuropathy, coronary artery disease, and cerebrovascular events (Blondon et al., 2014). Dietary recommendations focus on the quantity and quality of carbohydrate intake, as these factors directly influence glucose regulation. The GI serves as a quantitative measure to assess the postprandial effect of carbohydrate-containing foods on blood glucose levels. A number of clinical trials have demonstrated that low-GI diets effectively reduce postprandial blood glucose, improve glycaemic control, and decrease truncal fat and body weight in patients with T2DM (Li et al., 2014; Stenvers, 2014; Pavithran, 2020).

Despite the extensive research on the consumption of high glycaemic index foods in patients with type 2 diabetes mellitus, the persistent high consumption of such foods among the general population, including individuals with T2DM, necessitates further investigation. Therefore, this literature review aims to identify the impact of high glycaemic index food consumption on patients with type 2 diabetes mellitus.

Method

This study employed a narrative review methodology to describe, accumulate, and synthesise existing research evidence pertaining to the impact of high glycaemic index (GI) food consumption in patients with type 2 diabetes mellitus. The development of this narrative review involved a systematic series of stages, commencing with the formulation of a search framework through to data extraction and analysis. The initial stage in the article search strategy involved the application of the PICO (Population, Intervention, Comparison, Outcome) framework. This framework was operationalised as follows: the population of interest was patients diagnosed with type 2 diabetes mellitus. The intervention under observation was the non-consumption of high GI foods, which was then compared to the condition of consuming high GI foods. The outcome measured was the impact of high GI food consumption on this population.

To facilitate the identification of relevant articles and journals, the search strategy utilised keywords designed to both broaden and narrow the search results. In this study, the search strategy employed a combination of English keywords as follows: (“effect” OR “impact” OR “influence” OR “leverage” OR “connection” OR “relationship” OR “relation”) AND (“food consumption” OR “dietary habit” OR “diet” OR “glycaemic index” OR “high glycaemic index”) AND (“diabetes” OR “diabetes mellitus” OR “type 2 diabetes mellitus”). Articles included in this study met the following inclusion criteria: written in English, providing full text, and specifically evaluating the impact of high GI food consumption in patients with type 2 diabetes mellitus. Conversely, articles lacking full text, preprint articles that had not undergone peer review, and manuscripts still in the proofreading stage were excluded to minimise the potential for changes in research findings.

This study utilised secondary data, systematically obtained from previous studies rather than through direct field observation. The search for relevant articles was conducted across six electronic databases: Google Scholar, Science Direct, Scopus, PubMed, and ProQuest. The investigation of articles involved reviewing relevant English-language articles. Following the removal of duplicates, articles deemed suitable based on their abstracts were also considered.

Study selection was facilitated by the Mendeley bibliographic software. The selection process involved abstract screening followed by full-text screening. Articles or studies considered irrelevant to the research objective were excluded. Study quality assessment was conducted by the authors under the guidance of a supervisor, considering the following aspects based on Webb (2019): Actuality (when the information was published and the significance of the research findings for the current context), Relevance (the degree of importance of the information to the research question), Authority (the authors' credentials and the journal's reputation, including the peer-review process), Accuracy (the trustworthiness of the information and the presence of potential writing errors), and Purpose (whether the research is independent or has commercial or ideological biases).

The data extraction process was conducted by two researchers. Article eligibility was evaluated based on the analysis of titles, abstracts, and the overall content of the articles. Subsequently, specific study characteristics were extracted, including methodology, study design, sample size, and findings related to the impact of high GI food consumption in patients with type 2 diabetes mellitus. Study articles relevant to the research topic were systematically reviewed and analysed qualitatively to generate a narrative synthesis.

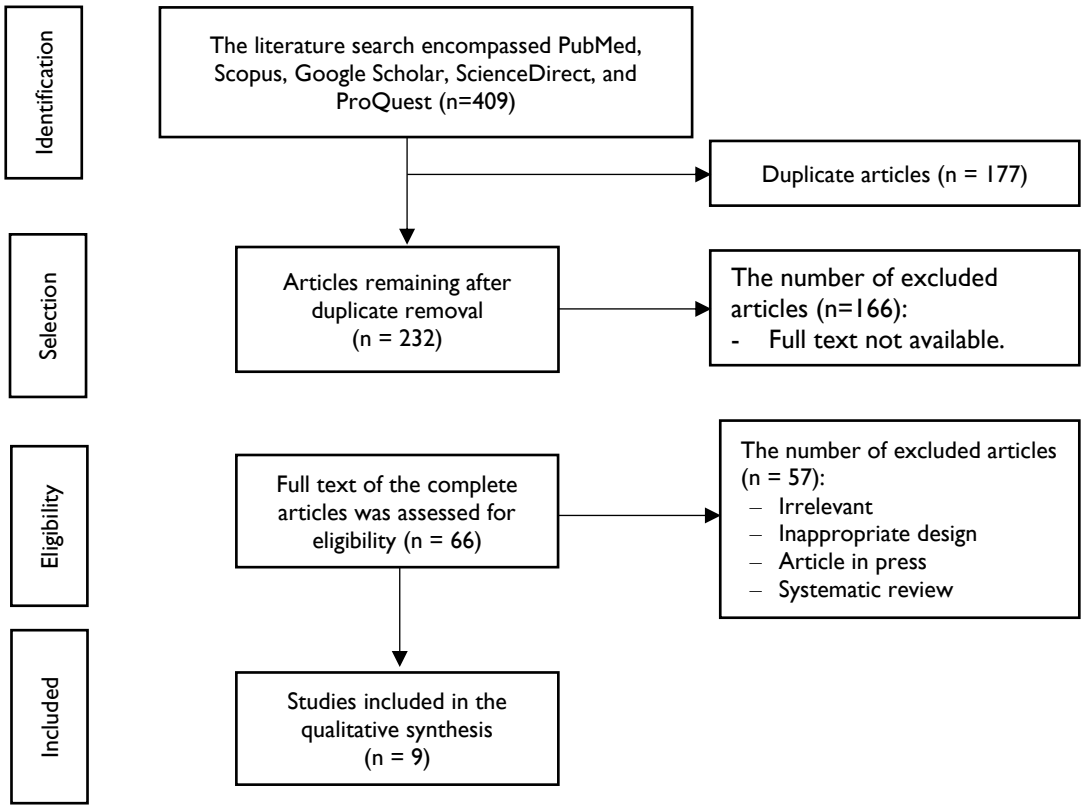

Figure 1. Flow diagram of the search and study selection process

Results

Table 1. Description of the studies reviewed

Authors and Year	Title	Method	Results	Database
Argiana V, et al, 2020	Low-glycemic-index/load desserts decrease Glycemic and insulinemic response in patients with Type 2 diabetes mellitus	*Quasy experiment*	The area under the glucose increment curve was significantly lower for the low-GI desserts compared to the control ($p < 0.001$). Serum triglycerides and the area under the glucose increment curve did not decrease between the two trials. Satiety visual analogue scale ratings were significantly higher after the consumption of low-GI desserts compared to conventional desserts. Similarly, hunger, desire to eat, and visual analogue scale ratings of the amount of additional food were significantly lower after the consumption of low-GI desserts compared to the control. The consumption of low-GI desserts demonstrated a positive impact on metabolic parameters in patients with T2DM.	*Google scholar*
Chang CR, et al, 2019	Restricting carbohydrates at breakfast is sufficient to reduce 24-hour exposure to postprandial hyperglycemia and improve glycemicvariability	*Quasy experiment*	A very-low-carbohydrate breakfast significantly reduced postprandial hyperglycaemia after breakfast ($P < 0.01$) and did not adversely affect glycaemia after lunch or dinner. Consequently, overall postprandial hyperglycaemia (24-hour incremental area under the glucose curve) and glycaemic variability (mean amplitude of glycaemic excursions) were reduced with the very-low-carbohydrate breakfast (24-hour incremental area under the glucose curve: -173 ± 361 mmol/L; $P = 0.03$; mean amplitude of glycaemic excursions: -0.4 ± 0.8 mmol/L per 24 hours; $P = 0.03$) compared with a standard macronutrient profile breakfast based on dietary guidelines. Pre-dinner hunger was lower with the low-carbohydrate breakfast compared with the standard macronutrient profile breakfast based on dietary guidelines (P-interaction = 0.03).	*Scopus*
Stenvers, DJ, et al, 2014	Breakfast replacement with a low-glycaemic response liquid formula in patients with type 2 diabetes: a randomised clinical trial	*Quasy experiment*	A liquid meal replacement with a low glycaemic response is a potential dietary approach to reduce postprandial glycaemia in patients with type 2 diabetes. However, clinical trials1 on the effects of replacing multiple meals on long-term glycaemia in poorly controlled patients are needed before liquid meal replacements with a low glycaemic response can be adopted as a dietary approach for the treatment of type 2 diabetes.	*Google scholar*
Wolever TMS, 2008	The Canadian Trial of Carbohydrates in Diabetes (CCD), a 1-y Controlled trial of low-glycemic-index dietary carbohydrate in type 2 Diabetes: no effect on glycated hemoglobin but reduction in C-reactive protein	*Cross-sectinal*	In subjects with T2DM managed by diet alone with optimal glycaemic control, long-term HbA1c was unaffected by changes in the glycaemic index or amount of dietary carbohydrate. The total:HDL cholesterol difference between diets had disappeared by 6 months. However, because of sustained reductions in postprandial glucose and C-reactive protein, a low-GI diet may be preferable for the dietary management of T2DM.	*Scopus*
Gomes JMG, 2017	Low glycemic index diet reduces body fat and attenuates inflammatory and metabolic responses in patients with type 2 diabetes	*Quasy experiment*	A low glycaemic index diet reduces body fat and prevents the negative metabolic and inflammatory responses induced by a high glycaemic index diet.	*Pubmed*
Ma Y, et al, 2008	A Randomized Clinical Trial Comparing Low-Glycemic Index versus ADA Dietary Education among Individuals with Type 2 Diabetes	*RCT*	Compared with the American Diabetes Association diet, a low-glycaemic index diet achieved equivalent HbA1c control with the use of less diabetes medication. Although limited in size, this trial suggests that a low-glycaemic index diet is a viable alternative to the American Diabetes Association diet.	*Scopus*

Similä, ME, 2011	Low, medium, and high glycaemic index carbohydrates and risk of type 2 diabetes in men	*Cross-sectional*	Dietary glycaemic index and glycaemic load were not associated with diabetes risk, and replacing lower glycaemic index carbohydrates with higher glycaemic index carbohydrates was not consistently associated with a lower risk of diabetes. The association of dietary glycaemic index and glycaemic load with diabetes risk should be interpreted with consideration of nutrient correlations, as foods may have different properties that affect risk.	*Scopus*
McGeoch SC, et al, 2011	Food Intake and Dietary Glycaemic Index in Free-Living Adults with and without Type 2 Diabetes Mellitus	*Cross-sectional*	Patients with T2DM may already consume a diet with a lower glycaemic index than the general population, but further efforts are needed to reduce the dietary glycaemic index and achieve other nutritional targets.	*Google scholar*
Li Di, et al, 2014	Taking a Low Glycemic Index Multi-Nutrient Supplement as Breakfast Improves Glycemic Control in Patients with Type 2 Diabetes Mellitus: A Randomized Controlled Trial	*RCT*	These data suggest measurable health benefits associated with the replacement of a conventional breakfast with a low glycaemic index multi-nutrient supplement in patients with T2DM. This simple dietary strategy for controlling blood glucose and body weight warrants further investigation and consideration by healthcare practitioners.	*Scopus*

Discussion

This research highlights several key points regarding dietary management for patients with type 2 diabetes mellitus. The study indicates that desserts with a low glycaemic index (GI) or glycaemic load (GL) can significantly reduce postprandial (after-meal) glucose and insulin responses compared to conventional desserts. This suggests that incorporating low-GI foods into the diet of individuals with T2DM may be a practical strategy to improve metabolic control and mitigate the risk of hyperglycaemia, a critical concern in diabetes management. This research paves the way for further investigation into the long-term effects of low-GI diets on diabetes management and the potential of this dietary modification to reduce diabetes-related complications, such as cardiovascular disease (Argiana V, et al., 2020).

Reviewing the study by Chang et al. (2019), the primary finding is that consuming a very low-carbohydrate, high-fat breakfast can significantly reduce postprandial hyperglycaemia and improve glycaemic variability in individuals with type 2 diabetes. This simple and feasible strategy may make a substantial difference in daily glucose control. The study also found evidence of reduced cravings for sweet foods with the low-carbohydrate breakfast, which could aid in weight loss among individuals with type 2 diabetes. Furthermore, this study highlights important aspects of improved glycaemic control, such as the observation that a very low-carbohydrate, high-fat breakfast substantially reduces postprandial glucose excretion, particularly in the morning, a period when individuals with type 2 diabetes often experience the highest blood glucose spikes. This can lead to better overall glycaemic control throughout the day. Additionally, the study suggests that this dietary modification is a relatively straightforward and practical strategy to implement, making it an accessible option for type 2 diabetes patients seeking to manage their blood glucose levels without adhering to highly restrictive diets.

Based on the findings of Stenvers et al. (2014), the key outcome of this research is that the use of a liquid formula with a low glycaemic response as a breakfast replacement for patients with type 2 diabetes resulted in decreased postprandial glycaemia and improved long-term glycaemia compared to a free-choice breakfast. The low glycaemic response formula also led to reductions in fasting plasma glucose levels, HbA1c levels, and body weight. However, no significant differences were observed between the low glycaemic response formula and the free-choice breakfast group regarding fasting plasma lipid levels, blood pressure, or waist circumference. Overall, this study suggests that using a low glycaemic response liquid formula as a breakfast replacement may be a promising dietary approach for patients with type 2 diabetes.

The implications of the study by Stenvers et al. (2014) provide evidence for the potential use of a low glycaemic response liquid formula as a breakfast replacement for patients with type 2 diabetes. The research findings indicate that the use of a low glycaemic response formula can reduce postprandial glycaemia and improve long-term glycaemia, as well as decrease fasting plasma glucose levels, HbA1c levels, and body weight. These results are significant as they suggest that low glycaemic response liquid formulas could be a promising dietary intervention for the management of type 2 diabetes, a health issue of increasing global prevalence. The use of continuous glucose monitoring in this study to measure postprandial glucose excretion also provides a more accurate and detailed assessment of glycaemic control, which may have implications for future research in this field. Overall, the findings of this study have the potential to influence clinical practice by providing a novel dietary approach for the management of type 2 diabetes.

Reviewing the study by Wolever (2008), the main finding of the Canadian Trial of Carbohydrates in Diabetes (CCD) is that a low glycaemic index (GI) diet did not significantly affect glycated haemoglobin (HbA1c) levels in patients with type 2 diabetes compared to high-GI or low-carbohydrate diets. However, the low-GI diet resulted in a significant reduction in C-reactive protein levels, a marker of inflammation. The study also found no significant differences in body weight, blood pressure, or blood lipid levels among the three diets.

The research by Wolever (2008), the Canadian Trial of Carbohydrates in Diabetes (CCD), has several important implications for the management of type 2 diabetes. Firstly, the study's finding that a low-GI diet did not significantly affect glycated haemoglobin (HbA1c) levels in patients with type 2 diabetes suggests that a low-GI diet may not be superior to other diets for glycaemic control. However, the study did find that a low-GI diet resulted in a significant reduction in C-reactive protein levels, a marker of inflammation. This indicates that a low-GI diet may have other health benefits beyond glycaemic control, such as reducing inflammation and potentially lowering the risk of cardiovascular disease. Overall, the findings of this research contribute to the evolving understanding of the role of diet in managing type 2 diabetes and provide important insights into the potential benefits of low-GI diets for reducing inflammation in these patients. The

study's results may also inform dietary recommendations for patients with type 2 diabetes and assist healthcare providers in developing more personalised dietary plans for these individuals.

Based on the study by Gomes (2017), the primary finding is that a low glycaemic index diet can reduce body fat and improve inflammatory and metabolic markers in patients with type 2 diabetes. After 30 days, the low-GI group showed significant reductions in body fat percentage, waist circumference, and fructosamine concentrations, as well as improved insulin sensitivity and lipid profiles. In contrast, the high-GI group showed no significant changes in these parameters.

Similarly, the study by Ma et al. (2008) reported the main finding that a low glycaemic index diet and the American Diabetes Association (ADA) diet achieved comparable reductions in glycated haemoglobin (HbA1c) levels at 6 and 12 months. However, the low-GI diet group was less likely to initiate or increase the dosage of diabetes medication. There were no significant differences in improvements in blood lipids, weight loss, or other measures between the two groups. This study concluded that a low-GI diet achieved equivalent HbA1c control with less diabetes medication use, suggesting that this diet may be a viable alternative to the ADA diet. However, the study had limitations due to its small size and recommended further evaluation in larger randomised controlled trials.

The implications of the research by Ma et al. (2008) provide evidence that a low glycaemic index diet can achieve comparable glycated haemoglobin (HbA1c) level control compared to the American Diabetes Association (ADA) diet in individuals with type 2 diabetes. The study also found that the low-GI diet group was less likely to initiate or increase the dosage of diabetes medication. This suggests that a low-GI diet may be a viable alternative to the standard ADA diet for managing glycaemic control in individuals with type 2 diabetes. However, the study acknowledges its limitations due to its small size and recommends further evaluation in larger randomised controlled trials to validate these findings.

Based on the findings of Similä et al. (2011), the key outcome of this research is that dietary glycaemic index and glycaemic load (GL) were not associated with an increased risk of type 2 diabetes in a cohort of Finnish men. The study also found that replacing medium-GI carbohydrates with high-GI carbohydrates was inversely associated with diabetes risk, but replacing low-GI carbohydrates with medium- or high-GI carbohydrates was not associated with risk. The study identified beer and milk as the main food groups contributing to inter-individual variation in dietary GI. Overall, this research concluded that dietary GI and GL were not related to diabetes risk and that further research using multivariate nutrient density models may provide new insights into this topic.

Reviewing the findings of McGeoch et al. (2011), the main observation of this study is that individuals with type 2 diabetes mellitus (T2DM) consumed a relatively healthy diet, with more servings of whole grains, dietary fibre, and a slightly lower dietary glycaemic index than a comparable group of obese individuals without T2DM. The study also found that the volunteers could achieve dietary GIs comparable to those used in dietary intervention studies that have resulted in improved glycaemic control, reinforcing the benefits of dietary intervention as first-line management in type 2 diabetes. Nevertheless, the data suggest that more education needs to focus on reducing salt and saturated fat intake and encouraging further increases in fruit and vegetable consumption.

The research by McGeoch et al. (2011) provides valuable insights into the dietary habits of individuals with type 2 diabetes mellitus (T2DM) and highlights the potential benefits of a low glycaemic index diet for T2DM patients. The study found that T2DM patients may already be consuming a lower-GI diet than the general population, but further efforts are needed to reduce dietary GI and achieve other nutritional targets. The study also suggests that dietary advice should focus on reducing salt intake and increasing fruit and vegetable consumption. The findings of this research may have implications for clinical practice, as they reinforce the benefits of dietary intervention as first-line management in type 2 diabetes.

Based on the study by Li et al. (2014), the primary finding is that replacing breakfast with a low glycaemic index (GI) multi-nutrient supplement improved glycaemic control in patients with type 2 diabetes mellitus (T2DM) without reducing energy intake. The study found lower body mass index (BMI) and waist-to-hip ratio in the treatment group at week 12 compared to baseline, suggesting that this supplement is an effective way to promote weight loss in T2DM patients. Furthermore, the research suggested a blood pressure-maintaining effect of the low-GI breakfast replacement. The supplement had no effect on the nutritional status of the patients.

The implications of the research by Li et al. (2014) are that replacing breakfast with a low glycaemic index multi-nutrient supplement can improve glycaemic control in patients with type 2 diabetes mellitus (T2DM) without reducing energy intake. The study also found that the supplement is an effective way to

promote weight loss in T2DM patients. Additionally, the research suggests a blood pressure-maintaining effect of the low-GI breakfast replacement. The findings of this study may have implications for the development of dietary interventions for T2DM patients.

These studies are supported by previous research reporting that diets with a low glycaemic index (GI) and glycaemic load (GL) can improve glycaemic control, blood lipids, blood pressure, and BMI in prediabetes and type 2 diabetes (T2DM) (Peres M, et al., 2023). Diets with high carbohydrate intake in the morning appear to result in higher glycaemic variability but lower average glucose and fasting blood glucose when compared to diets with low carbohydrate intake in the morning and higher carbohydrate intake in the evening (Rasmussen L, et al., 2020).

Based on another study, it was also reported that postprandial insulin concentrations were greater after a high glycaemic index test meal compared to a low glycaemic index test meal at baseline ($p = 0.004$), but not after the intervention ($p = 0.17$). Postprandial glucose after the high glycaemic index test meal increased after the intervention, being significantly higher than after the low glycaemic index test meal (35%, $p < 0.001$). Mean daily glucose concentrations decreased in both groups after the intervention. The 24-hour glycaemic variability index decreased in the low glycaemic index group compared to the high glycaemic index intervention group (Bergi RE, et al., 2022).

Conclusion

The findings of this research underscore the importance of understanding the glycaemic index of dietary intake in patients with type 2 diabetes mellitus. Integrating low glycaemic index foods into the diet of individuals with type 2 diabetes may represent a practical strategy for improving metabolic control and reducing the risk of hyperglycaemia. Enhanced glycaemic control, such as that achieved through the consumption of a very-low-carbohydrate, high-fat breakfast, substantially reduces postprandial (after-meal) glucose excretion, particularly in the morning, which is a period when individuals with type 2 diabetes frequently experience the highest blood glucose spikes.

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