

**Dr. Diego Fernández García.**

Specialist in Endocrinology and Nutrition, Hospital Virgen de la Victoria (Málaga, Spain).

Head of the Endocrinology and Nutrition Department, Hospital Vithas Xanit (Benalmádena, Spain).



# Risks and Benefits of Low Carbohydrate Diets in People with DM

**C**arbohydrate restriction has gained increasing popularity as a complementary nutritional therapy for managing diabetes. However, there is still controversy due to the limited scientific evidence available regarding its safety and efficacy, especially in the long term, compared to the nutritional approaches currently recommended for diabetes management (1).

In recent years, there has been a growing interest in the use of low-carbohydrate diets, or very low-carbohydrate diets, also known as ketogenic diets, as a complementary therapeutic option to pharmacological therapy. Ketogenic diets were a cornerstone of diabetes therapy, both for people with type 1 diabetes mellitus (T1DM) and type 2 diabetes mellitus (T2DM), before the development of insulin (2). However, it is only recently that they have been included as a possible recommendation in clinical practice guidelines (3).

There are many variations of carbohydrate-limited or restricted diets, ranging from moderate to very low carbohydrate diets, and a strict definition is yet to be agreed upon. However, Feinman provided the most widely used categories of carbohydrate-centered diets. A **moderate carbohydrate diet** is between 130 and 230 grams per day or 26% up to 45% of daily energy intake based on 2000 kcal/day. A **low-carbohydrate diet** contains >130 g or < 26% of daily energy intake, and a very low-carbohydrate diet, or ketogenic diet, is 20 to 50 g per day or 10% of daily energy intake (4). The goal of the diet is to achieve nutritional ketosis that provides the relevant benefits while minimizing the risks of known ketoacidosis.

When evaluating the potential benefits of this nutritional therapy, it is important to differentiate both the type of diabetes the individual has and the pharmacological therapy they are receiving, as the presence of insulinopenia and the use of complex insulin therapies will increase the short-term risk of both hypoglycemia and ketoacidosis.

## TYPE 2 DIABETES MELLITUS

Within the pathophysiology of T2DM, obesity and insulin resistance play a fundamental role. A recent systematic review and meta-analysis revealed that both low-carbohydrate and ketogenic diets produce beneficial effects in diabetes control compared to other diets in people with T1DM (5). These findings show significant reductions in baseline blood glucose, postprandial glucose, and HbA1c levels. All of this is achieved by reducing parameters associated with insulin resistance, while also improving glycemic variability.

Since diabetes is a cardiovascular disease, the use of these diets is also useful as they

can, especially in the short term, lead to significant weight loss and improvements in other cardiovascular risk parameters such as blood pressure, lipid profiles, and inflammation markers.

Emerging evidence suggests that there may be greater preservation of muscle mass and more favorable changes in body composition during ketogenic diets compared to other conventional low-fat hypocaloric diets.

Finally, the use of these diets has been reported to improve various quality of life items compared to conventional diets.

Adherence and non-compliance are limiting factors of these diets that contribute to the lack of long-term studies for diabetes management. Adherence has been shown to improve through supportive interventions from the multidisciplinary team treating the person with diabetes (6).

Among the **risks** associated with these diets, short-term increases in the incidence of ketoacidosis and hypoglycemia are seen, particularly in those using complex insulin regimens. However, existing evidence shows that the short-term risk of these complications is relatively low and can be minimized with advice from your health care team.

Other potential risks of these diets may be related to deficiencies in micronutrients and various vitamins. Significant changes in bone metabolism have been described in both children and adults, possibly related to alterations in vitamin D metabolism.

## TYPE 1 DIABETES MELLITUS

Before the discovery of insulin, strict low-carbohydrate diets with **severe carbohydrate restriction** ( $\leq 10$  g/day) were the only available option for treating T1DM. Despite the many therapeutic advances made since those days, the management of patients with T1DM continues to be suboptimal in terms of glycemic control. Additionally, the risk of weight gain and living with obesity is increasingly common in people with T1DM.

There is even greater uncertainty and ambiguity surrounding the suitability of a low-carbohydrate diet for individuals living with T1DM. Unlike other types of diabetes, T1DM is generally not a condition that can »

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## MOST CLINICAL PRACTICE GUIDELINES DO NOT RECOMMEND A LOW-CARBOHYDRATE DIET FOR PEOPLE WITH TYPE 1 DIABETES MELLITUS DUE TO THE LACK OF EVIDENCE REGARDING ITS SAFETY AND EFFICACY PROFILE



» be metabolically reversed. As a result, T1DM treatment primarily consists of a generalized insulin therapy approach, and there is a widely accepted consensus that a nutritional approach, including ketogenic diets, to “treat” only individuals with T1DM is unlikely to be effective and is possibly dangerous due to concerns about the increased risk of diabetic ketoacidosis and hypoglycemia. However, recent evidence supports the use of continuous glucose monitoring to prevent any episodes of hypoglycemia or ketoacidosis (7).

Available evidence shows significant reductions in HbA1c and daily insulin doses. Furthermore, the frequency of hypoglycemia is reduced, and glycemic variability improves, with more stable trends and avoiding spikes after meals. This translates into greater peace of mind for individuals with T1DM.

Most clinical practice guidelines **do not recommend a low-carbohydrate diet for individuals with T1DM** due to the lack of evidence regarding its safety and efficacy. Its use may be considered short-term under healthcare team supervision to minimize risks and optimize outcomes. It is not recommended for children, pregnant women, or those planning a future pregnancy (8).

### GESTATIONAL DIABETES

Gestational diabetes is a type of diabetes that develops or is diagnosed for the first time during pregnancy. It affects up to 18% of all women, and like T2DM, the first-line approach is lifestyle intervention, as up to 70% can be adequately controlled with lifestyle and nutritional modifications. Currently, there is no evidence, including randomized controlled trials, supporting the use of »

- » low-carbohydrate diets as treatment for those with gestational diabetes (Yong 2021) (9).

Emerging studies have shown that higher intake of animal proteins during pregnancy may be associated with a higher risk of gestational diabetes. It has also been suggested that such a diet during pregnancy in those with gestational diabetes may even worsen insulin sensitivity.

Other concerns surround the long-term impact of maternal nutritional ketosis and its potential negative effect on fetal

neuronal development and organ damage, **making its use inadvisable.**

## SAFETY

Low-carbohydrate diets are not suitable for some patients with diabetes, including pregnant or breastfeeding women, children and adolescents, people with eating disorders or at risk of eating disorders, or individuals with kidney disease. Additionally, due to the increased risk of diabetic ketoacidosis, patients taking SGLT-2 inhibitors should avoid very low-carbohydrate/keto diets. **D**

## CONCLUSIONS

It seems clear that low-carbohydrate diets have favorable short-term metabolic and weight-reducing effects, as well as improvements in baseline glucose, postprandial glucose, and HbA1c levels. Similarly, given the lack of long-term evidence, the use of these diets remains questionable.

The latest recommendations do not indicate a single eating pattern for people with diabetes, suggesting that meal planning and macronutrient distribution should be based on an individualized assessment of current eating patterns, preferences, and metabolic goals.

Reducing carbohydrate intake is a useful option, but it requires regular periodic reevaluation.

More large-scale, long-term, well-designed randomized trials on this topic are needed to evaluate the long-term safety and efficacy profile

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