

Lowering carbohydrates to support blood glucose management in type 1 diabetes



**TYPE 1 DIABETES
FAMILY CENTRE**



Who is this guide for?

This guide has been written for diabetes healthcare professionals who are interested in learning about the benefits of a lower carbohydrate approach to type 1 diabetes management, including endocrinologists, general practitioners, diabetes educators, dietitians and nurses.

Who can benefit from a lower carbohydrate diet?

Everyone living with type 1 diabetes can benefit from a lower carbohydrate approach to blood glucose management. This guide refers to the well, non-pregnant adult living with type 1 diabetes, including those with Latent Autoimmune Diabetes of Adults (LADA).

Other individuals may benefit, including individuals diagnosed with type 2 diabetes who have been prescribed insulin or medication and individuals whose pancreatic function is compromised.

Children, pregnant women, the very elderly and those with significant co-morbidities (especially advanced renal disease) are outside the scope of this guide.

What is a lower carbohydrate approach?

Clinical Definitions

Low carbohydrate

Between 50 and 130 grams of carbohydrate per day

Ketogenic "keto" diet

Less than 50 grams carbohydrate per day

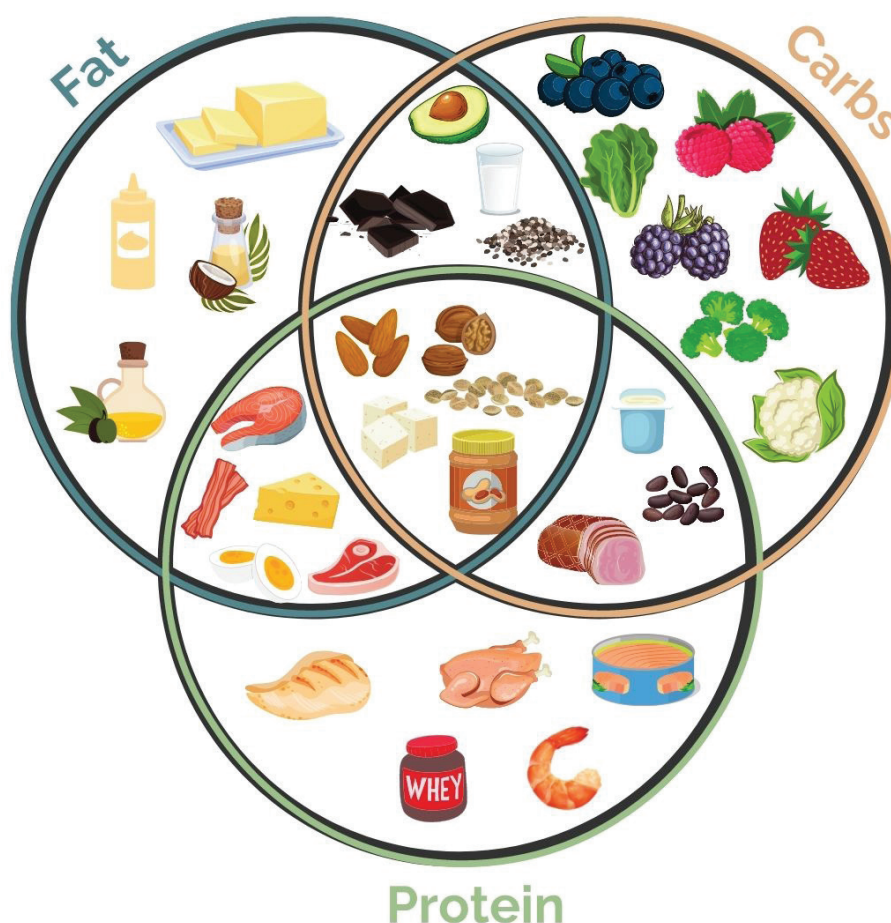
We are not advocating for a ketogenic approach in type 1 diabetes.

Our Definition

Lower carbohydrate approach

A non-prescriptive, flexible and patient led approach that involves any level of reduction from an individual's usual level of carbohydrate intake.

What does a lower carbohydrate diet include?



- Nutrient-rich foods from all macronutrient groups
- Carbohydrates are not explicitly avoided and include non-starchy vegetables, dairy foods such as milks and yoghurt; some fruit and nuts and seeds
- Small portions of carbohydrates, such as breads, pastas and condiments may be used, or individuals may opt for lower carbohydrate alternatives
- A variety of protein from both animal and plant sources, to meet the individual's protein requirements and promote satiety
- Fats from nuts and seeds, dairy foods, avocado and oils are included to meet energy requirements, add flavour and promote with satiety

An exciting and enticing diet full of healthy and delicious lower carbohydrate food

What does this look like across the day?

50 grams
of carbohydrate
per day



80 grams
of carbohydrate
per day



130 grams
of carbohydrate
per day



Variety, choice, flexibility and deliciousness are the key!

Key Takeaways:

- A lower carbohydrate approach is not a diet, it is simply a way of eating that can reduce the impact on blood glucose levels
- Carbohydrates need not to be avoided, just reduced to a desired level of intake
- Food quality, quantity, enjoyment and overall nutrition do not need to be sacrificed
- Flexibility and fluidity are key, higher carbohydrate meals can be included as desired, when eating out, when options are limited or for special occasions

Why consider a lower carbohydrate approach?

There are three main components involved in delivering an insulin dose for a meal. Each of these components brings with it a level of inaccuracy that significantly impacts the final insulin dose and may result in extreme hyperglycaemia or hypoglycaemia. The burden of dose calculation and the fear of 'getting it wrong' is very real and people with type 1 diabetes often report they avoid social situations in which food is involved.

Elements of insulin dosing – why is it hard?

Carbohydrate counting

- Carbohydrate counting is a complicated skill to master
- Regulation allows nutrition information panels and apps a 25% discrepancy
- Eating outside the home makes identifying and measuring carbohydrates difficult

Insulin to carbohydrate ratio

- Determined using a 'one-size fits all' calculation
- Requires regular assessment and adjustment
- Body's response to carbohydrate is fluid, so these ratios are rarely accurate

Rapid acting insulin

- Pharmacokinetics of rapid acting insulin cannot precisely match the endless combinations of macronutrients consumed
- Advanced insulin bolusing techniques may help but are difficult to implement and add another layer of complexity to an already complicated dosing equation

Insulin dosing is risky business!



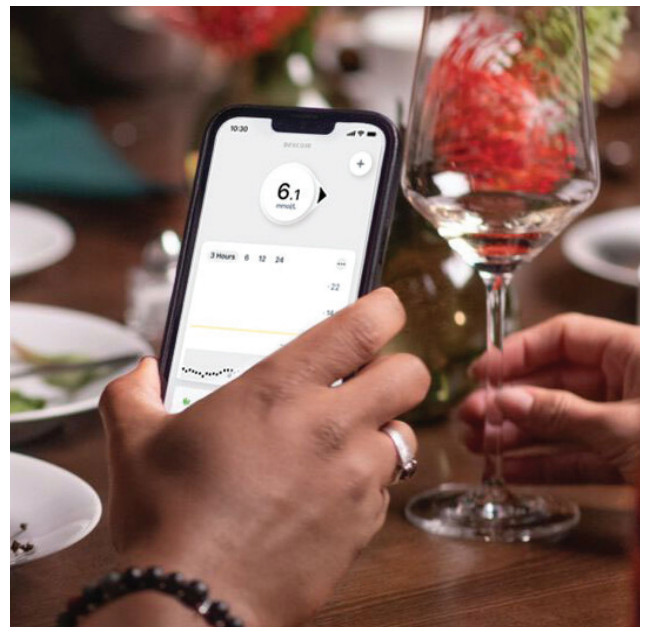
Is there another tool we can add to the toolbox?

'Carbohydrate titration' – the missing piece of the insulin dosing equation

The point here is this; people with type 1 are completing complex calculations and working with imperfect tools. Carbohydrate counting and insulin dose adjustment is an imperfect science with dire consequences for inaccuracy.

The more carbohydrates there are in a meal, the more unpredictable the glycaemic response will be and the more difficult it will be to dose insulin to match it.

Knowing this, we can support lowering the carbohydrate content of meals to minimise the error involved in the amount and timing of an insulin dose. Not to mention, reduce the anxiety around calculating and dosing insulin.



The Law of Small Numbers

Eating smaller amounts of carbohydrate in any meal will require smaller doses of insulin. With smaller doses of insulin, the margin of error will be smaller. This reduces the risk of both hyperglycaemia and hypoglycaemia.



High carbohydrate breakfast

60 grams carbohydrate

5078kj, 72g fat, 72g protein

Total insulin dose: 8 units

+20% margin of error: 10 units

-20% margin of error: 6 units



Reduced carbohydrate breakfast

6 grams carbohydrate

2491kj, 45g fat, 45g protein

Total insulin dose: 1 Units

+20% margin of error: 1 units

-20% margin of error: 1 units

How might an individual start a lower carbohydrate approach?

An individual's lower carbohydrate approach is exactly that, individual! There are many ways to get started, but speaking to a knowledgeable dietitian is a good place to start. The key is to ensure energy needs are met and a variety of foods are consumed, to promote satiety and enjoyment. And of course, to do so safely!

Getting started

- Tackle one meal at a time; small changes can have big results, encouraging further changes
- Slightly reduce the carbohydrate at each meal
- Identify the carbohydrate foods eaten most often, or in greatest amounts, and reduce
- Reduce high glycaemic index or high glycaemic load foods/meals that have significant impact on blood glucose levels
- Choose a level of carbohydrate and get help from a dietitian to build a flexible daily meal plan to suit



What are the risks and how do we manage them?

Diabetic Ketoacidosis

To understand why diabetic ketoacidosis is not an inherent risk of a low-carbohydrate diet, it is important to understand the difference between 'nutritional ketosis' and 'diabetic ketoacidosis'.

Nutritional ketosis	Diabetic ketoacidosis
May have low level ketones	Blood ketone levels high
Adequate insulin for body's needs(both basal and bolus insulin)	Insufficient insulin for body's needs
Blood glucose in healthy range	Blood glucose levels generally high
No symptoms of DKA	Symptoms of DKA present
No potential cause of DKA	Potential cause of DKA e.g., illness, infection, failed pump site/insulin pen, alcohol/drug

Lowering carbohydrate intake alone will not increase the risk of DKA, even if low levels of ketones are present due to nutritional ketosis

The role of the HCP

Every person living with type 1 is at risk of DKA, regardless of their dietary intake, so it is important they have the knowledge and tools required to recognize and manage the condition should it occur.

Ensure the individual:

- Understands the potential causes of DKA and is aware of their personal symptoms
- Periodically monitors blood ketone levels, to determine a baseline level for which to base any potential increase against
- Has a ketone monitoring device and that they can interpret blood ketone readings
- Has an up-to-date sick day management plan and understands when to seek emergency support



Hypoglycaemia

When we reduce the carbohydrate consumed in a meal, the total bolus insulin dose required is also reduced. Subsequently, any errors in administration occur in smaller insulin increments and are unlikely to result in hypoglycaemia, and even less likely rapid or severe hypoglycaemia. Individuals report that hypoglycaemia is often milder and easier to treat, requiring less rapid-acting glucose to 'fill' the extra insulin, resulting in reduced risk of rebound hyperglycaemia.

The role of the HCP

Ensure the individual:

- Understands there is no 'low carbohydrate' treatment for hypoglycaemia
- Revisit hypoglycaemia treatment protocols
- Discuss the potential for a reduced amount of rapid-acting glucose treatment and when a follow-up carbohydrate may be required

There is no low carbohydrate treatment for hypoglycaemia!

Lipid profiles

The pathophysiology of lipid changes is complex, and research is ongoing.

Concerns around changes in lipid profiles are generally linked to the misconception that lowering carbohydrates promotes unrestricted consumption of saturated fat, leading to an increase in total and LDL cholesterol. We do know that lipid profiles can change when someone significantly lowers their carbohydrate intake, however, which lipid and the extent of the change is very individual and will reflect the level of carbohydrate reduction and the composition of the diet itself.

Marked atherogenic changes have been seen in individuals consuming a calorie deficient diet, and lipid profiles improve if calorie intake increases to requirements.

The role of the HCP

- Refer to a knowledgeable dietitian to ensure energy sufficiency, a variety of protein and fat and adequate fibre
- Refer to endocrinologist/GP for baseline and ongoing lipid testing
- Flag potential concern if history of heart disease or familial heart conditions
- Consider other lifestyle factors that may be impacting lipid profile such as alcohol and smoking

Disordered eating

Every person living with type 1 diabetes, due to the nature of their condition, is at risk of developing an “abnormal” relationship with food and eating. Identify foods containing carbohydrates, counting carbohydrates and calculating insulin doses naturally increases one’s focus on food. Weight changes at diagnosis; body dissatisfaction; diabetes burden; and increased pressure to maintain a healthy weight and HbA1c also play a role.

A lower carbohydrate approach does not inherently increase this risk of developing an eating disorder. In fact, a reduced carbohydrate diet may have a positive impact on someone who is exhibiting abnormal thoughts around food. Eating less carbohydrates means less insulin, so less chance of significantly under or overdosing. This means less follow-up corrections and fewer hypoglycaemia treatments, helping to lessen the focus on food and blood glucose management.

However, a close scrutiny of food intake is an inherent risk for disordered eating, and all patients with type 1 diabetes should be screened for disordered eating and supported accordingly.

The role of the HCP

- Know the warning signs of disordered eating; insulin restriction, increased hyperglycaemia, DKA
- T1D specific screening (mSCOFF1)* and specialist referral if required.

**American Diabetes Association Diabetes and Emotional Health Workbook*

The Diabetes Care Team's role in supporting lowering of carbohydrate intake

Any change in an individual's type 1 diabetes management requires a supportive, transparent and collaborative approach from each member of the diabetes team. This includes the endocrinologist, general practitioner, diabetes educator, dietitian, psychologist and most importantly, the individual with type 1 diabetes. Each member has their role to play within their scope of practice and communication is vital.

Practical implications for the health care team

With any change in diet, there will inevitably be a subsequent change in insulin requirements.

- Reinforce the importance of carbohydrate counting and refer to dietetics for education
- Review the principles of insulin adjustment
- Encourage the use of a bolus calculator and assess the effectiveness of bolus ratios
- Assess the need for basal insulin changes over time, especially if weight changes occur
- Discuss alternate bolus techniques for lower carbohydrate, high protein, higher fat meals
- Encourage timely lipid testing and review of medications other than insulin, particularly other glucose lowering medications



Not sure where to start?

The Type 1 Diabetes Family Centre has a long history of supporting patients looking to explore lower carbohydrate approaches to their management. If you want to learn more about helping your patients navigate a lower carbohydrate approach to blood glucose management or are looking for experts to refer to, the Type 1 Diabetes Family Centre has you covered.

Learn more on our website: www.type1familycentre.org.au
We're only a phone (or video) call away!

Type 1 is all we do! Our specialist clinic

Our two senior clinicians are both Accredited Practising Dietitians and Credentialed Diabetes Educators, world renowned for their work in therapeutic carbohydrate reduction for type 1 diabetes management. Type 1 is all they do, and they can assist your patients to safely and effectively transition to a lower carbohydrate approach. Our clinicians offer face to face and virtual clinic options to rural and interstate patients. Want us to guide your patients through this journey? Just need a bit of expert advice?

Contact the clinic: clinic@type1familycentre.org.au or refer here: www.type1familycentre.org.au/new-referral

Type 1 Essentials is a comprehensive online type 1 education course covering the fundamentals of life with the world's most complex self-managed condition. Alongside topics including alcohol, exercise, technology and much more, the course includes a module that introduces the concept of lowering carbohydrates as a simple and effective way to improve blood glucose management and reduce the mental load of living with type 1 diabetes.

The world's first online carbohydrate counting course that brings carbohydrate counting education into your kitchen. Learn to identify carbohydrates and use nutrition information panels and carbohydrate counting apps. Follow along to carbohydrate count a recipe and get some great tips on making carbohydrate counting when eating out safer and more effective.

Access the online courses here: www.t1learning.com

Carb Conscious Cookbook

Interested in lowering carbohydrate intake but not sure where to start? Our cookbook is full of delicious lower carbohydrate meals and snacks, suitable for the whole family. Created by our senior dietitian, Amy Rush, each recipe has been tried and tested in the Family Centre Kitchen by our type 1 mini-chefs.

Available in hard copy and e-book: www.type1familycentre.org.au/shop

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