

Dear Doctor,

Your patient has enrolled in the *Defeat Diabetes Program* which takes a low carbohydrate eating approach to improve glycaemic control in patients with type 2 diabetes (T2D).

As you may be aware, there has been increased interest in low carb and ketogenic ('keto') approaches to T2D, and it is recognised by leading bodies such as the CSIRO and the American Diabetes Association.

The *Defeat Diabetes Program* has been formulated by Australian doctors and dietitians and is based on the latest scientific literature.

This is not a crash diet, does not use shakes or supplements, and is not extremely low in calories.

It is a real food approach which minimises the intake of sugars and starches (bread, potato, pasta, rice). A similar program in the UK with over 400,000 participants has had a success rate of over 50% and is endorsed by the NHS. Details of our program are available at www.defeatdiabetes.com.au.

Medication Information

Medications for type 2 diabetes often need adjustment when carbohydrate intake is reduced to reduce the risk of hypoglycaemic episodes (insulin, sulfonylureas), or more rarely, ketoacidosis (SGLT2 inhibitors). Specific considerations are shown below, along with some further background information.

1. Anti-hyperglycaemic agents

a) **Insulin**

Very low carbohydrate eating (VLC) containing less than 30 grams of daily dietary carbohydrates is recommended for patients on insulin therapy. This is to minimise post-prandial glycaemic variability and the associated risk of hyper- or hypoglycaemic episodes during the transition period.

Consider changing long-acting insulins to insulin glargine (or similar).

- Very low carb eating (VLC) < 30g/day:
 - Cease fast-acting insulin, reduce basal insulin doses by 50-80% from day one
 - Monitor blood sugar before and after meals and titrate as needed

- Low carb eating (<100g/day):
 - Cease fast-acting insulin, reduce basal insulin doses by 30-50% from day one
 - Monitor blood sugar before and after meals and titrate as needed

b) **Metformin**

No need for dose reduction.

- c) **Sulfonylureas**
Reduce by 50% if pre commencement HbA1c <7.5% (discontinue if on minimum dose)
- d) **SGLT2 inhibitors**
Cease due to increased risk of euglycaemic ketoacidosis.
- e) **Incretins**
No need for dose reduction if used in isolation.
- f) **Glitazones (thiazolidinediones)**
Discontinue if pre-commencement HbA1c < 7%

2. Anti-hypertensives

- a) **ACE I / ARBS / Calcium-channel blockers / Beta blockers / Thiazides / thiazide-like diuretics**
If BP <120mmHg systolic, or 20mmHg less than prior to commencement of low carbohydrate eating, withhold next dose of anti-hypertensive and consider dose reduction. Consideration should be given to ceasing diuretics should be ceased first, followed by beta-blockers.
- b) **Warfarin**
Dose changes may be necessary. Increased frequency of INR monitoring is recommended.
- c) **Valproate**
Monitor levels for changes due to narrow therapeutic range.

Background

Low-carbohydrate approaches to eating are gaining increasing acceptance as a first-line treatment for diabetes, including as a recognised diet by the American Diabetes Association. In Australia, a private medical Facebook group dedicated to low carb and ketogenic eating currently has more than 1,800 members. Indeed, many medical professionals now consider the balance of evidence is overwhelmingly in favour of low carbohydrate eating and its use in diabetic patients should be a foregone conclusion. Despite these changing tides, information regarding the use of low carbohydrate eating in a medical sense remains extremely limited at all levels of medical education. Consequently, many doctors may feel they lack the required knowledge to oversee the transition of diabetic patients to low carbohydrate eating. The goal of this document is to provide an overview of common areas requiring medical oversight.

The most important thing for medical practitioners to be aware of with respect to the commencement of reduced carbohydrate approach is the potential need for **medication changes** including de-prescribing. This most commonly includes *diabetic and anti-hypertensive medications*. Many

patients may also be able to down titrate other medications, including those for gastro-oesophageal reflux, analgesics and antidepressants. Some patients may also wish to engage in discussion regarding the benefits of ongoing cholesterol-lowering therapy.

The most dramatic impact on physiology of commencing a low carbohydrate approach is the rapid reduction in glucose levels due to the removal of large amounts of dietary glucose in the form of sugar or starch.

Insulin and sulfonylurea medications present a high risk of hypoglycaemic episodes if not reduced prior to commencement of a low carbohydrate approach. For patients on these medications, very low carbohydrate eating (VLC) containing less than 30 grams of daily dietary carbohydrates is recommended. This is to minimise postprandial glycaemic variability and the associated risk of hyper- or hypoglycaemic episodes during the transition period.

Understand that the most important goal in the transition period is not to achieve normoglycemia, but to safely wean patients off insulin or other hypoglycaemic medications. It is, therefore, preferable to aim for mild hyperglycaemia (8-10 mmol/L) rather than risk hypoglycaemia.

Sliding scale insulin is unlikely to be needed on very low carbohydrate eating as patients will not be consuming a significant amount of carbohydrate-containing foods. If a sliding scale is to be continued, then doses should be appropriately reduced to reflect the reduced carbohydrate content of meals. Short-acting insulin may be needed to correct blood glucose excursions over 11 mmol/L to bring them towards 8mmol/L.

It is recommended that all fast-acting insulin be ceased at the time of initiation of a very low carbohydrate eating, and basal insulin levels be reduced by 50% to 80%. Blood glucose levels should be measured at least four times per day, with the use of a continuous glucose monitor preferred. Sulfonylurea drugs may be halved in dose or ceased completely depending on glycaemic control assessed via HbA1c.

There is a risk of euglycaemic diabetic ketoacidosis in patients taking SGLT2 inhibitors. These should always be ceased on commencement of a low carbohydrate eating.

Reduction in blood pressure is both predictable and common on reduced carbohydrate eating. This results from a reduction in glucose-stimulated insulin release which inhibits the sodium retaining function of four renal transporters activated by insulin. Two recommendations arise from this:

1. Firstly, patients should be advised to ensure an adequate sodium intake of 4 g or more per day (equivalent to approximately 2 teaspoons). Given low carbohydrate approaches generally eschew processed foods, the regular sodium intake of many patients may drop dramatically. If attention is not given to adequate sodium intake, symptoms such as postural hypotension and headache are common. Since 2017, the *Australian Dietary Guidelines* have not recommended an upper limit of sodium intake for individuals. Over time, blood pressure should be monitored to allow for appropriate down titration of antihypertensive therapy. We suggest the removal of diuretic medication first, followed by beta-blockers.
2. There is a perception that a low carbohydrate approach to eating is necessarily **low in fibre**. While a discussion regarding the merits of dietary fibre is beyond the scope of this letter,



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many patients may actually consume higher levels of dietary fibre on low carbohydrate eating by way of fibrous vegetables such as cauliflower and broccoli, nuts and seeds, and fruits such as berries. Ironically, this high fibre intake can actually lead to abdominal discomfort by way of fermentation by gas-producing microbes, and moderation of high fibre foods may actually improve symptoms. Another common cause of gastrointestinal distress on low carb eating arises through excess consumption of artificial sweeteners as contained in commercial low carbohydrate bars. These artificial sweeteners, commonly sugar alcohols all polyols, can exert an osmotic effect which leads to diarrhoeal symptoms.

High fat low carbohydrate foods are generally very well tolerated in those who have had a **previous cholecystectomy**. If there are any concerns, a history seeking any signs of malabsorbed fat such as an oil slick in the toilet bowl should be taken. A trial of bile salts could also be considered, however, this has never been necessary in the authors' experience.

A history of **gout** or elevated uric acid is not a contraindication to low carbohydrate eating. While a transient elevation of uric acid may be seen due to competition between uric acid and ketone bodies for renal excretion in the early phase of the diet, this does not appear to increase the risk of gout attacks over baseline.

As with any dietary change, **INR** may be subject to change. Because LCK eating often involves changes in consumption of vitamin K-containing vegetables, monitoring of International Normalized Ratio (INR) should be more frequent in patients taking warfarin.

If you have any queries, please do not hesitate to contact one of us through the website (www.defeatdiabetes.com.au).

Best wishes,



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