Low-Carbohydrate Diets for Management of Type 2 Diabetes: A Primer

Key points
In people with type 2 diabetes, carbohydrate restriction can cause a clinically relevant reduction in post-prandial glucose concentrations (can be as much as 4mmol/L difference). The effect on fasting glucose is unclear.

Reductions in post-prandial glucose can occur without any weight loss which may be attractive for patients and may be easier to sustain.

It may also help a patient reduce medications - in particular prandial insulin - which may also be a benefit.

Carbohydrate restriction is nearly always associated with increased HDL-cholesterol and reduced triglycerides.

Weight loss with any diet will lower fasting and post-prandial glucose concentrations, and improve CVD markers. There is no evidence for meaningful superiority of any diet for weight loss, probably due to hormonal counter-regulatory responses which drives hunger, and lowers energy expenditure. The best diet for weight loss is one a patient likes and can stick to long-term.

The exact cut-off below which carbohydrate restriction is effective is not clear, but in most studies the amount of carbohydrate in the diet is less than 20-25% of calories, which is about 100-120g carbohydrate per day.

Dietary fat will replace most of the carbohydrate, but some people may choose to increase their protein slightly. The evidence is not clear how the replacing food or macronutrient influences glycaemia and CVD risk.

Carbohydrate restriction does not permanently *fix* type 2 diabetes, and re-introduction of carbohydrates causes a return to pre-diet glucose concentrations especially if the person has not lost weight.

There is some evidence that the LDL-C raising effect of saturated fat does not occur with marked carbohydrate restriction. Nevertheless, replacing foods high in saturated fat such as butter with foods high in unsaturated fats such as vegetable oils lowers CVD risk factors even in the setting of a low-carbohydrate diet. Therefore, encouraging the consumption of unsaturated fat sources to replace the carbohydrate is a sensible course of action.

Where to apply caution

- Moderate restriction of carbohydrate does not lower postprandial glucose to any meaningful degree (probably due to small adaptive changes in insulin secretion, insulin-dependent and non-insulin dependent glucose uptake).
• If the moderately restricted carbohydrate is replaced by foods high in saturated fat, there can be a rise in atherogenic-cholesterol, and in some people, this may be marked.
• A small number of studies examining a high-protein diet (about 30% of calories; 130-150g per day) for 2 years in people with type 2 diabetes have not shown any negative effects on renal function, but the long-term effects of such an approach are not clear.
• Patients on insulin and sulphonylurea should be monitored closely to ensure they do not increase their risk of hypoglycaemia. The reductions in glucose occur immediately, so patients should reduce their insulin dose immediately.

Good online resources for patients to help them count carbohydrate grams etc include:

http://Fixingdad.com
http://www.diabetes.co.uk/ (The Low Carb Program)
https://www.dietdoctor.com/ (Requires payment)
https://www.virtahealth.com/ (Requires payment)

Further Reading for Practitioner

Effect of a high-protein, low-carbohydrate diet on blood glucose control in people with type 2 diabetes. (This paper and others by this author show clinically significant reductions in post-prandial and 24-hour glucose).

The effect of a low-carbohydrate, ketogenic diet versus a low-glycemic index diet on glycemic control in type 2 diabetes mellitus (shows improvement in medications).

Systematic review and meta-analysis of dietary carbohydrate restriction in patients with type 2 diabetes. (indicates a cut-off for effectiveness)
http://drc.bmj.com/content/5/1/e000354

Comparison of isocaloric very low carbohydrate/high saturated fat and high carbohydrate/low saturated fat diets on body composition and cardiovascular risk (shows that blood glucose rises following reintroduction of carbohydrate).
https://nutritionandmetabolism.biomedcentral.com/articles/10.1186/1743-7075-3-7

Long-term effects of a very-low-carbohydrate weight loss diet compared with an isocaloric low-fat diet after 12 months (shows elevated LDL-C).
Modification of lipoproteins by very low-carbohydrate diets. (Useful review on atherogenic potential of saturated fat on a low-carbohydrate diet).

Differential metabolic effects of saturated versus polyunsaturated fats in ketogenic diets

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. (Moderate reduction of carbohydrate has no effect on glycaemia in the absence of weight loss)

Note: 15/8/2018 The evidence for carbohydrate/fat diets and what is best for diabetics, is presently being reviewed by the Scientific Advisory Committee on Nutrition/Diabetes UK/NHS England joint working party. This Factsheet will be updated when they report.