Low carbohydrate diet to achieve weight loss and improve HbA1c in type 2 diabetes and pre-diabetes: experience from one general practice

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Abstract

Patients with diabetes have long been exhorted to give up sugar, encouraged instead to take in fuel as complex carbohydrate such as the starch found in bread, rice or pasta (especially if 'wholemeal'). However, bread has a higher glycaemic index than table sugar itself. There are no essential nutrients in starchy foods and people with diabetes struggle to deal with the glycaemic load they bring. The authors question why carbohydrate need form a major part of the diet at all. The central goal of achieving substantial weight loss has tended to be overlooked. The current pilot study explores the results of a low carbohydrate diet for a case series of 19 type 2 diabetes and pre-diabetes patients over an eight-month period in a suburban general practice.

A low carbohydrate diet was observed to bring about major benefits. Blood glucose control improved (HbA_{1c} 51±14 to 40±4mmol/mol; $p<0.001$). By the end of the study period only two patients remained with an abnormal HbA_{1c} (>42mmol/mol); even these two had seen an average drop of 23.9mmol/mol. Weight fell from 100.2±16.4 to 91.0±17.1kg ($p<0.0001$), and waist circumference decreased from 120.2±9.6 to 105.6±11.5cm ($p<0.0001$). Simultaneously, blood pressure improved (systolic 148±17 to 133±15mmHg, $p<0.005$; and diastolic 91±8 to 83±11mmHg, $p<0.05$). Serum gamma-glutamyltransferase decreased from 75.2±54.7 to 40.6±29.2 U/L ($p<0.005$). Total serum cholesterol decreased from 5.5±1.0 to 4.7±1.2mmol/L ($p<0.01$).

This approach is easy to implement in general practice, and brings rapid weight loss and improvement in HbA_{1c}. Copyright © 2014 John Wiley & Sons.

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Key words

type 2 diabetes; low carbohydrate diet; weight loss; primary care; diabesity; obesity; fatty liver; liver enzymes

Background

Before the discovery of insulin and modern drugs, carbohydrate (not just sugar) restriction was the only realistic treatment for all diabetes.[1] More recently, the drive has been for a low fat and therefore higher carbohydrate diet for all. It is interesting to note that despite the plethora of 'low fat' and 'diet' foods on the supermarket shelves, the epidemic of central obesity and diabetes (diabesity) continues to increase across the developed world. After years of demonising fats some researchers are starting to look at carbohydrate as a cause of central obesity and diabetes.[2,3] In 2012, Emily Hu *et al.* showed a linear dose-relationship between rice consumption and risk of type 2 diabetes in a study involving more than 350 000 subjects.[4]

The authors' interest was first sparked by the fact that even wholemeal bread (GI index 71) or baked potato (GI index 85) has a higher glycaemic index than table sugar itself (GI index 68).[5] Dr John Briffa in his excellent book 'Escape the diet trap'[6] makes the point that, while fats contain the essential vitamins A, D, E and K, carbohydrate represents 'empty calories'. So why should people with diabetes take in the 'concentrated sugar' that is in starchy foods such as bread, pasta or rice at all?

Studies have shown good results for a low carbohydrate/higher fat diet in people with type 2 diabetes and in those with central obesity.[2,3,7] However, the approach is generally frowned upon in the UK, despite the fact that many patients are trying it of their own accord. Googling 'diabetes.co.uk forum low carb', the low carbohydrate success stories have had over 81 000 views. In 2011, a detailed pathophysiological study showed that diet-induced weight loss brought about falls in the fat content

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So what should I eat to control Diabetes or Pre-diabetes?

Reduce starchy carbs a lot (remember they are just concentrated sugar). If possible cut out the 'White Stuff' like bread, pasta, rice – though porridge, new potatoes and oat cakes in moderation may be fine. Sugar – cut it out altogether, although it will be in the blueberries, strawberries and raspberries you are allowed to eat freely. Cakes and biscuits are a mixture of sugar and starch that make it almost impossible to avoid food cravings; they just make you hungrier!!

All green veg/salads are fine – eat as much as you can. So that you still eat a good big dinner try substituting veg such as broccoli, courgettes or green beans for your mash, pasta or rice – still covering them with your gravy, bolognese or curry! Tip: try home-made soup – it can be taken to work for lunch and microwaved. Mushrooms, tomatoes, and onions can be included in this.

Fruit is trickier; some have too much sugar in and can set those carb cravings off. All berries are great and can be eaten freely; blueberries, raspberries, strawberries, apples and pears too, but not tropical fruits like bananas, oranges, grapes, mangoes or pineapples.

Proteins such as in meat, eggs, fish – particularly oily fish such as salmon, mackerel or tuna – are fine and can be eaten freely. Plain full fat yoghurt makes a good breakfast with the berries. Processed meats such as bacon, ham, sausages or salami are not as healthy and should only be eaten in moderation.

Fats (yes, fats can be fine in moderation): olive oil is very useful, butter may be tastier than margarine and could be better for you! Coconut oil is great for stir fries. Four essential vitamins A, D, E and K are only found in some fats or oils. Please avoid margarine, corn oil and vegetable oil. Beware 'low fat' foods. They often have sugar or sweeteners added to make them palatable. Full fat mayonnaise and pesto are definitely on!!

Cheese: only in moderation – it's a very calorific mixture of fat, carbs and protein.

Snacks: avoid. But un-salted nuts such as almonds or walnuts are great to stave off hunger. The occasional treat of strong dark chocolate 70% or more in small quantity is allowed.

EATING LOTS OF VEG WITH PROTEIN AND FATS LEAVES YOU PROPERLY FULL in a way that lasts.

Finally, about sweeteners and what to drink – sweeteners have been proven to tease your brain into being even more hungry making weight loss almost impossible – drink tea, coffee, and water or herb teas. I'm afraid alcoholic drinks are full of carbohydrate – for example, beer is almost 'liquid toast' hence the beer belly!! Perhaps the odd glass of red wine wouldn't be too bad if it doesn't make you get hungry afterwards – or just plain water with a slice of lemon.

Where to get more info?

A book – 'Escape the diet trap' by Dr John Briffa (2013).[6] Well researched and easy to read.

Internet – Google 'about.com low carb diet' for loads more info and recipes, or look into the closely related PALEO DIET; also Google 'diabetes.co.uk forum low carb' for contact, recipes and hints.

BEFORE YOU START get an accurate weight and measure your waist, re-weigh and measure once a week to see how you are doing and ask for help if problems or little progress is being made – GO ON DO IT!!!

Box 1. Advice sheet for patients

of the liver and pancreas and returned blood glucose control to normal.[8] In November 2013, a Swedish expert committee, SBU (Swedish Council on Health Technology Assessment), published their inquiry 'Dietary Treatment for Obesity'. According to SBU, the only clear difference among different dietary recommendations is seen during the first six months. Here a low carbohydrate diet is more effective than today's conventional advice.

We decided to trial the low carbohydrate weight loss diet in a suburban general practice for patients with raised HbA_{1c} (>42mmol/mol [6.0%]). In particular, we wondered how any weight loss would be matched by an improvement in other measured parameters such as HbA_{1c} and blood pressure (BP). There were early concerns about the effect a diet with more eggs and butter in it would have on serum cholesterol levels. The question of the acceptability of the approach was central and so it was decided to provide group sessions for support and information sharing. We also wondered if group work could help offset some of the costs of this approach.

Method

Over a couple of months the approach was suggested opportunistically to patients with raised HbA_{1c} during routine GP or practice nurse appointments, or by approaching people on the impaired glucose tolerance register of the practice. The age range was 34–73 years. It was important that the patients choose freely if this was of interest. The diet sheet (Box 1) was handed out with the repeated emphasis on 'cut out sugar, bread, pasta, rice and potatoes altogether'. Baseline measurements of weight, waist, BP, cholesterol, liver function, thyroid and renal function were made. The patient was asked to make a second 10-minute appointment if they wanted to take this further.

At the second appointment the diet sheet was discussed so the patient could tailor the diet to their life. Patients appreciated that we tried very hard to help them understand how and why the diet could help them achieve their goal of weight loss and health gain. It was found to be better to spend more time on this than being too prescriptive about the diet itself. No weighing of food was required; patients were reminded to 'cut out the carbs' while eating more vegetables, healthy fats and protein to avoid hunger. Patients were given a choice of monthly 10-minute one-to-one reviews of progress or attending our evening 'Low Carb' group meetings. About half opted for each. All patients were weighed at each review

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and usually had a BP check and waist measurement. Blood tests (HbA1c, cholesterol, liver function, renal function) were repeated on average every two months.

The emphasis at follow up was reflecting upon what worked for each patient and identifying personal goals, while giving advice on how to better tailor the diet to individual needs. It was notable that participants never lost their results sheets and were keen to have the latest figures added on. We also handed out graphs of their progress to engage their families.

Results

All data are expressed as mean ± standard deviation. A two-tailed paired student's t-test was used to compare data before and after intervention.

Nineteen patients entered the programme with just one dropping out in the early stages (though there was weight loss, the diet just didn't suit the individual). Of the 18 who persisted with the diet, all had substantial weight loss. Initial weight fell from 100.2±16.4 to 91.0±17.1kg (mean weight loss 8.6±4.2kg; $p<0.0001$). Waist circumference decreased from 120.2±9.6 to 105.6±11.5cm ($p<0.0001$).

Blood glucose control improved significantly (HbA1c 51±14 to 40±4mmol/mol; $p<0.001$). Only two patients remained in the abnormal range (>42mmol/mol); even these two had seen an average drop of 23.9mmol/mol. Simultaneously, BP improved (systolic 148±17 to 133±15mmHG, $p<0.005$; and diastolic 91±8 to 83±11mmHg, $p<0.05$).

Serum GGT (gamma-glutamyltransferase) decreased from 75.2±54.7 to 40.6±29.2 U/L ($p<0.005$). Total serum cholesterol decreased from 5.5±1.0 to 4.7±1.2mmol/L ($p<0.01$).

Seven patients were able to come off medication: metformin (one completely and two have halved their dose), perindopril and lacidipine, as BP control improved so much. Additionally, metoclopramide, omeprazole and lanzoprazole were discontinued, as symptoms of acid reflux improved.

Box 1 provides a case example. All 18 participants lost weight and had improved HbA1c, and none had higher cholesterol. The majority reported improved energy and well-being, and many began exercising.

> In April 2013, a 55-year-old patient presented with tiredness, polydipsia and an HbA1c of 84mmol/mol. There was marked hepatomegaly; a fatty liver was confirmed on ultrasound scan, associated with deranged liver function tests (GGT was 103 U/L). After three months on a low carbohydrate diet her liver was normal on ultrasound, the HbA1c was down to 41mmol/mol, and GGT was 12 U/L. She reported feeling 'great, 10 years younger' and has lost 17cm off her waist.

Box 1. A case example

Discussion

It was observed that a low carbohydrate diet achieved substantial weight loss in all patients and brought about normalisation of blood glucose control in 16 out of 18 patients. At the same time, plasma lipid profiles improved and BP fell allowing discontinuation of antihypertensive therapy in some individuals.

Patients were found to be most motivated to diet when they had recently been diagnosed with hypertension, diabetes or pre-diabetes. We wonder if health professionals always make the most of this window of opportunity to work together with our patients on weight reduction. In the past, the doctors on the team simply delegated this to the dietitians, whereas showing real interest can demonstrate to our patients just how central weight loss can be to good health.

The authors were struck by the energy and enthusiasm as patients took control of their lives instead of waiting patiently for doctors and nurses to 'solve' their problems. As GPs we are more at home in charge of one-to-one consultations, so the first group sessions were a bit daunting. It helped to get into the habit of finding out what the patients' best hopes or goals were and what was going well so far. After a few meetings, members of the group were trying to help each other, often making sensible suggestions.

Repeatedly, patients would step on the scales expecting not to have lost weight, only to find that they had lost several kilograms; they were surprised by this as they had not felt hungry on the low carbohydrate diet but it had nevertheless worked. For some, carbohydrates appeared to be addictive and increase appetite, so that as they gave up carbohydrates they felt much less hungry. All patients reported increases in energy levels. An unexpected result of the diet was that two of the partners, the practice manager, the deputy practice manager and both practice nurses all went on the diet and remain on it.

The mechanistic basis of the normalisation of blood glucose control after significant weight loss has recently been explained.[8] Decrease in body fat brings about decrease in the ectopic fat in both liver and pancreas, and release from the fat-induced metabolic inhibition allows resumption of normal function.[9]

An initial concern had been the effect of increase in consumption of eggs and butter on serum cholesterol. The 15% improvement observed raises interesting questions about the cholesterol dogma. These questions have recently been well aired elsewhere.[10]

The 47% improvement in serum GGT was another unexpected finding. The patients with the highest initial levels seemed to improve the most, but on average there was a drop of approximately 35 U/L. For years, patients with raised GGTs had told us they didn't drink alcohol. Now that the role of carbohydrate in excess of requirements, especially the fructose component, is better understood in the genesis of fatty liver, it is clear that excess carbohydrates can be a cause of fatty liver.[9,11]

There are resource implications for this. The average person with diabetes required about 30 minutes of doctor or nurse time in the first month, then about 15 minutes per month. The groups run with about 8–10 patients in each time and last just over an hour, so this helped our efficiency. This level of support is not needed indefinitely: after about four months most can be 'discharged' to more routine follow up. Furthermore, this would be offset by possible drug budget savings.

An important consideration is the long-term outcomes of weight loss

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Key points

- It could be said that starchy foods such as bread, pasta or rice are just concentrated sugar, and as such may represent a block to good diabetic control; even wholemeal bread has a higher glycaemic index (71) than table sugar itself (GI index 68). This is the basis for the low carbohydrate diet currently gaining popularity via the internet
- A low carbohydrate diet was trialled in a primary care setting for 19 diabetic or pre-diabetic patients, bringing about improvements in health markers over an eight-month period. Blood glucose control improved – HbA_{1c} 51±14 to 40±4mmol/mol ($p<0.001$) – as did weight which fell from 100.2±16.4kg to 91.0±17.1kg ($p<0.0001$)
- Patients reported the diet was surprisingly easy to comply with and also noticed increasing energy levels. Seven patients were able to come off medication of one form or another

achieved with a low carbohydrate diet. This was investigated in a small study by Nielsen and Joenssen.[12] Sixteen people who lost weight on a low carbohydrate diet, from 100.6±4.7 to 89.2±4.3kg, without close follow up were 93.1±14.5kg after 44 months.[12] This study observed initial HbA_{1c} was 8.0±1.5% falling to 6.9±1.1% after 44 months.

A positive approach to achieving substantial weight loss in a suburban general practice has brought about normalisation of blood glucose control in most patients who engaged with this approach, and major improvements in serum cholesterol and liver enzymes in all. The clinical benefit is accompanied by possible cost benefits, despite need for increased time input.

Scientifically, this work represents only a small series of cases; also there is no evidence yet that the findings would generalise to other practices. However, even so, it offers some hope that there could be something an average practice team might do to help this group of patients enjoy better health.

Conclusions

Based on our work so far, we can understand the reasons for the internet enthusiasm for a low carbohydrate diet; the majority of patients lose weight rapidly and fairly easily; predictably the HbA_{1c} levels are not far behind. Cholesterol levels, liver enzymes and BP levels all improved. This approach is simple to implement and much appreciated by people with diabetes.

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Declarations of interests

There are no conflicts of interest declared.

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