‘Starchy carbohydrates with every meal is good advice’

For

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Carbohydrates consist of sugars, starches and fibres. Their primary role is to provide glucose to cells in the body. Glucose is the main energy source for the brain, central nervous system and red blood cells, which are the only carbohydrate-dependent cells. Glucose also can be stored as glycogen in liver and muscle.1

The role of carbohydrates has been the source of much public and scientific interest. This includes the relationship of carbohydrates with health outcomes, including cardiovascular disease (CVD), type 2 diabetes, bodyweight, and dental caries. However, no detrimental effects of carbohydrates as a source of calories on those or other health outcomes have been reported. In fact, a moderate body of evidence suggests that dietary fibre is essential for optimal digestive health, helps provide satiety, promotes healthy laxation and protects against CVD, obesity, type 2 diabetes and other long-term conditions.2,3 The energy value of digestible carbohydrates is generally accepted as four calories per gram. Research suggests that high-fibre diets can aid in weight control through lower energy yield.5 Few studies have linked carbohydrates to obesity. Indeed, successful weight loss and maintenance are linked to low-fat, high-carbohydrate diets in people with6 and without diabetes.7

Requirement of carbohydrate

The minimal amount of carbohydrate is determined by the brain’s requirement for glucose. A recommended dietary allowance (RDA) for carbohydrate of 130g/day for adults and children aged one year and older has been established.1

The acceptable macronutrient distribution range (AMDR) for carbohydrate is 45–65% of total calories.8 It is recommended that the majority of carbohydrate is derived from fibre-rich starchy food.9 A comparison of the RDA to the AMDR shows that the recommended range of carbohydrate intake is higher than the RDA. For example, if an individual with a caloric intake of 2000 kcal/day consumes 55% of calories as carbohydrate, 1100 kcal would be from carbohydrate. This equates to 275g carbohydrate, well above the RDA of 130g/day needed for brain function.

Guideline daily amounts (GDAs) translate science into consumer-friendly information. All values are based on the recommendations of the UK COMA (Committee on Medical Aspects of Food Policy) report on Dietary Reference Values.10 GDA values are broadly consistent between the UK, Europe and internationally. The GDA for total carbohydrates is calculated using 47% energy from carbohydrate.11

Carbohydrates in the diet of people with diabetes

Diabetes is viewed as a disorder of carbohydrate metabolism due to its impact on hyperglycaemia. Blood glucose concentration following a meal is determined by absorption of glucose in the blood stream and its clearance.12 Carbohydrate is the only macronutrient that has a direct impact on blood glucose. Nutritional recommendations, integral in diabetes management, have been an area of persistent controversy, particularly regarding the proportions and types of carbohydrate.

Before the advent of insulin therapy, dietary management was the only form of therapy for diabetes.13 Dietary prescriptions in that period emphasised strict restriction of carbohydrate intake and an increased intake of dietary fat.14,15 Later, as the serious cardiovascular complications of diabetes became recognised, nutritional recommendations for diabetes were sharply revised to moderate consumption of fats and liberalisation of carbohydrates.16,17

Today, diabetes dietary advice continues to play an important role, not only for the day-to-day control, but also for the prevention of complications. One of the most fundamental recent changes is the need for individualisation of nutrition prescription. Rather than prescribing a uniform proportion of fats and carbohydrates, current recommendations recognise that there is little evidence for the ideal macronutrient composition of the diet in the management of hyperglycaemia,18 although it has been shown that replacing saturated fat with starchy carbohydrates achieved beneficial effects on dyslipidaemia in type 2 diabetes.19 Thus, greater flexibility and consumption of macronutrients based on the GDA for healthy eating are encouraged.20,21

When people with diabetes receive carbohydrate awareness structured education and monitor carbohydrate consumption – whether by carbohydrate counting, exchanges, or experience-based estimation – they manage to improve glycaemic control and lose weight.22,23 Daily consistency in carbohydrate intake is associated with improved blood glucose control,23 although this may not apply to people on intensified insulin therapy who adjust their insulin dose based on their actual carbohydrate intake.24

Concerns about omitting starchy carbohydrates from meals

Humans can survive without an exogenous supply of carbohydrate. However, adaptation to a fat and protein fuel requires considerable metabolic adjustments. In the absence of dietary carbohydrate, synthesis of glucose requires amino acids derived from the hydrolysis of endogenous or dietary protein or glycerol derived from fat.1

Reviews of lower-carbohydrate diets have shown that weight loss is associated with the duration of the diet and restriction of energy intake, but not with restriction of carbohydrates.25 Reviews of people with diabetes have
demonstrated improvements in glycaemic control, fasting glucose, and triglycerides in the short term, but a systematic review that only included randomised controlled trials greater than 12 weeks, concluded that there were no consistent differences in weight and HbA1c over the longer term. There may be subtle, unrecognised and untoward effects of a low-carbohydrate diet that only become apparent when adopted by populations not genetically or traditionally adapted to it. Of particular concern are the long-term consequences of a chronic production of β-hydroxybutyric and acetoacetic acids (ketoads). There is evidence that a diet low in carbohydrate, deficient in wholegrains, water-soluble vitamins and some minerals, may result in nutritional deficiencies; arterial plaques and stiffness; hypertension, dyslipidemia and insulin resistance; bone mineral loss; kidney, bladder, and/or urethra stones; increased levels of homocysteine, free fatty acids and non-esterified fatty acids. It may also affect the development and function of the central nervous system and adversely affect an individual’s general sense of wellbeing.

Conclusion
Regular consumption of quantity-controlled fibrous carbohydrate is good advice. Because individuals with diabetes have a two- to four-fold increase in CVD risk compared to those without diabetes, it is even more important that healthy eating principles are incorporated. Although carbohydrates have a direct impact on glycaemia, there is no evidence that lowering glycaemic load by eliminating starchy carbohydrates from meals improves glycaemic control in the long term, and eliminating starchy carbohydrate from meals is more likely to result in the diet becoming deficient in health promoting nutrients such as wholegrains and excessive in atherogenic properties such as saturated fat.

People with diabetes should receive structured education so that they may identify and incorporate fibrous starchy carbohydrate into their meals but ensure that carbohydrate is not eaten to excess. Consumption needs to be appropriate for bodyweight, physical activity levels and glycaemic control (usually between the RDA, 190g, and the GDA, 230g for women and 300g for men). Food choices should be kept as easy and simple, and every effort should be made to increase, not restrict, the variety and flexibility in food choices. In determining diabetes nutrition-related education priorities, individuals need to know:
- Which foods contain carbohydrate,
- Appropriate portion sizes for carbohydrate foods,
- Carbohydrate servings (or grams) they should choose to eat for meals or snacks.

By using these principles, food records and, if necessary, blood glucose monitoring data, it can be determined if blood glucose goals are being met. If not, food intake or medications should be reviewed to determine what adjustments are required.

Declaration of interests
The author is Chief Executive of the charitable not-for-profit organisation, X-PERT Health.

References
References are available online at www.practicaldiabetes.com.

Against
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For many years, the standard advice for people with diabetes has been to eat starchy carbohydrates with every meal. Over the past few years, many people with diabetes have queried the wisdom of this, and the official line has now been softened. Although new guidance has removed this requirement, many patients were educated in the starchy carbohydrate era, and many documents and websites still quote it. As recently as last year, a spokesperson for Diabetes UK tried to defend this approach in a radio interview, with limited success.

Diet has always been an important component of the management of diabetes. Historical accounts suggest that, as diabetes was associated with excess glucose, a low-carbohydrate diet was deemed an appropriate treatment. Hence, until the 1990s, the recommended diet derived only 15% of calories from carbohydrate. By the 1970s, however, concern was growing that a low-carbohydrate diet was necessarily high in fat, and fat was seen as causing high cholesterol levels, heart disease and obesity. A healthy diet was considered to be one which is low in fat and high in carbohydrates, and it was felt people with diabetes should follow such a diet, rather than focus on reducing carbohydrates. Protein was also considered less safe, for fear it might be associated with renal problems. As a result, the recommended carbohydrate intake increased first to 40%, and then to over 50% of all calories – not necessarily because carbohydrates were good, but because fat and protein were bad.

In the 1970s, people with type 1 diabetes were treated with fixed doses of insulin (usually once or twice a day) and in order to avoid their glucose levels falling to too low, they were very sensibly recommended to eat carbohydrate-containing snacks between each meal, and to eat carbohydrates with every meal. However, there was little distinction in recommendations between type 1 and type 2 diabetes, and this advice became the norm for everyone with diabetes. With the move away from ‘diabetic diets’, people with diabetes were advised to follow national guidelines for a healthy diet, which also recommended starchy carbohydrates with every meal, as exemplified by the eat-well plate. On the Diabetes UK website, this advice is repeated for people with type 1 diabetes (see extract shown in Table 1) – despite the major advances in insulin management of type 1 diabetes, which made the 1970s-era advice obsolete.

How effective is this kind of advice? A few months ago, a lady came to see me in clinic and expressed concern that her blood glucose the previous evening had
Debate

‘Starchy carbohydrates with every meal is good advice’

<table>
<thead>
<tr>
<th>Food groups and what’s in a portion</th>
<th>How many portions do you eat in a day?</th>
<th>How many portions should you eat in a day?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread, cereals, rice, pasta and potatoes</td>
<td>I eat...</td>
<td>7–14 Include starchy foods at all meals</td>
</tr>
<tr>
<td>One portion is equal to:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 2–4 tbsp cereal</td>
<td></td>
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</tr>
<tr>
<td>• 1 slice of bread</td>
<td></td>
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<tr>
<td>• Half a small chapati</td>
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</tr>
<tr>
<td>• 2–3 crispbreads or crackers</td>
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<td></td>
</tr>
<tr>
<td>• 2–3 tbsp rice, pasta, cous-cous, noodles or mashed potato</td>
<td></td>
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<tr>
<td>• 2 new potatoes or half a baked potato</td>
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</tbody>
</table>

Table 1. Extract reproduced from Diabetes UK’s chart for eating well with type 1 diabetes. (www.diabetes.org.uk/Guide-to-diabetes/Food_and_recipes/Eating-well-with-Type-1-diabetes/A-healthy-balance/Getting-the-balance-right)

gone up to 26mmol/L. When I asked what she had eaten, she said she always kept to the right diet, and had eaten a baked potato. Let’s assume she followed the advice in Table 1 and had half a baked potato – this could equate to 50g of carbohydrate, which in itself could cause her glucose to rise by 15mmol/L or more.

It is now well-recognised that complex carbohydrates can have a similar effect on blood glucose levels as that of sugars, with baked potato and white rice having a glycaemic index of 85 and 98 respectively as they are, after all, quickly broken down to glucose. So, eating starchy carbohydrates with every meal risks pushing glucose levels up and up. Which begs the question – why treat diabetes, which is essentially an intolerance to glucose, with glucose?

Yet this has been the received wisdom for many years. Is it any wonder, therefore, that many doctors treating diabetes have lost confidence in the ability of patients to achieve control of their diabetes by lifestyle changes, and as a result hit the prescription pad? Is it any wonder that people with diabetes – in their thousands – consult their peers online for lifestyle advice that works? Like the person who wrote the following on the Diabetes Support Forum (http://diabetes-support.org.uk):

‘I’m type 2, diagnosed aged 62 in Nov 2009 and was about 4 stone overweight. I did a diabetes education course in March ’10. People were told at great length about the fat and sugar content of various foods and told to eat low-fat, starchy substrates (7 to 14 units every day), and “plenty of fruit and veg”. Fruit specifically included bananas, grapes, and orange juice. After I found this extremely helpful [internet] forum ... I try to keep my daily carbs below 100g, I maintain an HbA1c around 5.4% [36mmol/mol] by diet and keeping active in various ways, and so far need no medication. I have lost 3 stone in weight and hope to lose another 7–14 lb.’

Type 2 diabetes is a condition of insulin resistance, characterised by loss of control of hepatic glucose output (causing hyperglycaemia), and inability to manage ingested glucose. Increasing the latter will further exacerbate hyperglycaemia. Net result: increased insulin secretion (or injection), more insulin resistance, and more hyperglycaemia. In type 1 diabetes, the rediscovery of carbohydrate counting has enabled patients to assess the effect of different foods on their glucose levels. While, in theory, they can eat anything as long as they inject the right amount of insulin, many have learned that a lower carbohydrate load makes it easier to manage glucose control, requires a lower insulin dose, and encourages weight loss. They have also learned to appreciate the freedom that comes from having a carbohydrate-free meal; for example, when eating out and not wishing to have to inject insulin.

There is evidence that low-carbohydrate diets can be beneficial in type 2 diabetes, but these are often dismissed as Atkins-type diets or as high-fat diets. However, replacing carbohydrates with leafy vegetables, for example, will not increase fat content and yet will have a significant beneficial impact on glucose control. Even replacing a bowl of bran flakes with scrambled egg on toast reduces calorie intake, despite a small increase in fat content – yet with only 10g instead of 40g carbohydrate.

So abandoning the ‘starchy carbs with every meal’ slogan does not mean adopting a very low carbohydrate, high-fat diet. It is my experience that people with diabetes are finding it possible to eat healthily and improve diabetes control by restricting carbohydrate intake to around 100g a day.

There is light at the end of the tunnel. The Diabetes UK Nutrition Working Group in May 2011 issued new guidance which stated: ‘There is no evidence for a recommended ideal amount of carbohydrate for maintaining long-term glycaemic control in people with type 1 diabetes’, and that in type 2 diabetes: ‘The total amount of carbohydrate consumed is a strong predictor of glycaemic response.’ This would suggest that carbohydrate restriction is beneficial to glycaemic control, yet the eat-well plate is still used ubiquitously, which shows a third of the plate as carbohydrates, and there is a lack of specific advice.

The Diabetes UK website now states: ‘Dietary management of diabetes depends more on eating regularly and including starchy carbohydrate foods like pasta at meals, and including more fruit, vegetables and pulses in your everyday diet.’ While not explicitly stating ‘starchy carbohydrates with every meal’ the choice of words suggests something very similar – and that the end of the tunnel is still some way off.

Conclusion
Starchy carbohydrate with every meal is not good advice, and the diabetic professional community needs to provide meaningful advice to help people with diabetes make lifestyle changes that will help, not hinder, their efforts at good control of their diabetes.

Declaration of interests
There are no conflicts of interest declared.

References
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**References**


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