Aoife Hanna
Registered Dietitian

Aoife Hanna runs her own dietetic practice, EatRight Ireland. She sees clients for diabetes, weight management and IBS and is a member of the Irish Nutrition and Dietetic Institute. Aoife also sits on the Weight Management Interest Group Committee for the INDI.

For full article references please email info@networkhealthgroup.co.uk

LOW CARB DIETS AND TYPE 1 DIABETES: SHOULD WE BE WARNING OUR PATIENTS?

Low carbohydrate diets are everywhere these days. You just can't escape them, unless you switch off from all social media, TV, radio and never have a discussion about diet with anyone. Ever! So, it's understandable that those with Type 1 diabetes are asking, "What about me? Am I ok to reduce my carbohydrate intake too?"

Prior to the development of injectable insulin, low carbohydrate diets were the cornerstone for the treatment of diabetes. Since its discovery and with more flexible insulin regimes, people are encouraged to adopt a more 'regular' diet. For many, this means eating regular meals throughout the day, with each meal containing roughly the same amount of carbohydrate.

Over the last number of years, carbohydrate counting, and adjusting insulin dosage accordingly, has become the gold standard dietary management for Type 1 diabetes. In fact, NICE guidelines recommend carbohydrate counting should be offered to all adults six to 12 months after diagnosis.[1] This approach allows people with diabetes much greater flexibility and control over their diet, thus improving their diabetic control. However, this approach, for some, still yields suboptimal control.

We know that some patients have ended up restricting the amount of carbohydrates they eat, since large carbohydrate intake and a subsequent large insulin dose, led to increased unpredictability in their blood glucose levels. Additionally, many patients also report that they found themselves stuck in a carbohydrate 'rut'. They knew the amount of carbohydrates in certain foods, and the amount of insulin they needed for it, and as a result they adopted the "I'll stick to what I know" principle. We also now know that, even if the person with diabetes estimated their carbohydrate intake correctly, insulin absorption rates can vary by up to as much as 30% in some.

In 2013, while working in New Zealand, a patient of mine asked me, "Am I ok to follow a low carbohydrate diet, even though I have Type 1 diabetes?" I was a practising Diabetes Dietitian within the hospital at the time, and I was at a loss. But then we thought, if we're recommending insulin dose adjustments for carbohydrates that are consumed, surely we can dose adjust for carbohydrates that aren't being consumed? And further still, with less carbohydrate coming in, the unpredictability in blood glucose levels would be less. Therefore, restricting carbohydrates may have the potential to further improve glucose control when one is carbohydrate counting.

WHO IS FOLOWING A LOW CARB DIET?

I can say with certainty that any dietitian who has worked in the area of Type 1 diabetes has come across Dr Richard Bernstein, an 82-year-old American physician, who was diagnosed with Type 1 diabetes at the age of 12. He is probably the most famous advocate of low carbohydrate diets for the treatment of patients with both Type 1 and 2 diabetes. The author of six books on diabetes, his two most famous publications are *Diabetes Diet* and *Diabetes Solution*. His work is widely

published in numerous magazines and journals and, subsequently, he has received many awards for his contributions to the study of diabetes. Dr Bernstein adheres to a strict low carbohydrate diet, and has done so for years.[2]

Vinnie Santana, the fastest diabetic ironman athlete of all time, swears by Dr Bernstein's low carbohydrate approach.[3] However, it is worth noting that Vinnie wasn't following this low carbohydrate diet when he achieved his record breaking time. He has been following Dr Bernstein's advice (less than 30g carbohydrates per day) since 2012. Although he no longer competes professionally, in the early days of following this diet he found some of his training sessions exhausting. But, since increasing the amount of fat in his diet, Vinnie has been able to sustain a more vigorous and regular training regime. He reports, since reducing his carbohydrates, that his HbA1c has never been greater than 40mmol/mol.

Then there is Lewis Civin, a New Zealander who was diagnosed with diabetes at age 9. At age 38, he too completed an ironman event on a low carbohydrate, high fat diet under the guidance of his coach Stephen Farrell and Dr Bernstein's book, *Diabetes Solution*. What's interesting is Lewis discovered that, despite giving himself enough insulin to cover his carbohydrate intake, a large intake of protein would raise his blood glucose levels (BGL). To control this, he now keeps his protein intake to 30-40g per meal. Prior to beginning his low carbohydrate diet, he had a HbA1c of 53-64mmol/mol, but now reports a HbA1c of <42mmol/mol.[4]

WHAT ARE SOME OF THE POTENTIAL RISKS?

Diabetic ketoacidosis (DKA) occurs when the level of ketones rise in the blood in conjunction with a low level of insulin and is potentially life threatening. Ketones are a by-product of fat breakdown and are used as fuel for the body.

Franziska Spritzler, a registered dietitian from the USA and an advocate for low carbohydrate diets and diabetes, explains that 'nutritional ketosis' is normal when following a low carbohydrate diet and can occur when people with Type 1 diabetes follow this diet. She reports that it should not be confused with DKA.[4] Professor Grant Schofield of New Zealand, also publically supports the use of low carbohydrate diets in Type 1 diabetes. According to his research, there has been no published report of a Type 1 diabetic developing DKA on a carefully implemented low carbohydrate diet,[5] thus suggesting that there is a low risk of people with Type 1 diabetes developing ketoacidosis if following a correctly managed low carbohydrate diet.

Another consideration is the long-term cardiovascular risk that a high fat, low carbohydrate diet might have on people with diabetes. Dr Troy Stapleton is an Australian radiologist, who at 41 years of age, developed Type 1 diabetes. Having received standard diabetes education, he found it frustratingly difficult to manage his BGL. He diligently undertook carbohydrate counting and adjusted his insulin levels accordingly, but suffered from a hypoglycaemic episode, on average, once a week. In an interview with Dr Norman Swan, on Australia's ABC radio station

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in August 2013, he discussed how oxidative stress on the endothelium of blood vessels, due to a spike in BGL, causes acceleration of atherosclerosis in people with diabetes. He also explained that every 1% of HbA1c (HbA1c as per DCCT) increase above 29mmol/mol increases the risk of myocardial infarction by 14% and risk of micro-vascular complications by 35-40%. Since following a low carbohydrate, high fat diet, Dr Stapleton's BGL has gone from an average of 8.4mmol/l to 5.3mmol/l. His HbA1c at the time of the interview was 34mmol/mol. He also reports improved blood pressure, triglycerides, HDL and blood lipid profile since undertaking a low carbohydrate diet. He has gone from having a weekly hypoglycaemic episode, to about one a month. Dr Stapleton admits that the changeover from running off glucose to fat was challenging and he experienced symptoms of light-headedness, headaches, lethargy and muscle aches, lasting for approximately four to six weeks. He reports now feeling "completely normal".[7]

HAVE ANY TRIALS BEEN CONDUCTED?

In Sweden in 2005, Nielsen, Jönsson and Ivarsson found that 48 people with Type 1 diabetes, who followed a daily carbohydrate intake of 75g for 12 months, had mean HbA1c reductions from 57mmol/mol to 46mmol/mol, and a subsequent reduction of symptomatic hypoglycaemic from 2.9 to 0.5 per week.[8] After two years, 48% of the participants were still following this diet to some degree, suggesting that this diet can be adhered to long term. They have also maintained a HbA1c reduction compared to their original levels, which has lowered the risk of cardiovascular disease by approximately 40% accordingly. Additionally, the improvement seen in the total chol/HDL ratio at the two-year follow-up was estimated to reflect a 20% reduction in the risk of myocardial infarction.[9]

In New Zealand in 2014, a small pilot randomised control trial compared five people who undertook carbohydrate counting and advised to follow their standard diet, to five other people who also undertook carbohydrate counting, while being asked to follow a low carbohydrate diet. Those on the low carbohydrate diet were asked to restrict their carbohydrate intake to 50-75g of carbohydrate daily.[10] Unlike Nielsen's trial, the participants failed to achieve this low level of carbohydrate intake and ate an average of 100g of carbohydrate daily, as they found the diet very difficult to stick to. They reported that they felt like they were "starving", especially in the initials stages.[11] Similarly to that of Lewis Civin, some of the participants in this study found that the amount of insulin taken to cover the carbohydrate in their meals was inadequate, which is possibly caused by protein becoming a significant source of glucose owing to gluconeogenesis. So, if one was to consume larger quantities of protein when following a low carbohydrate diet, there may be a potential need for a carbohydrate and protein to insulin ratio to manage BGL.

This study showed that glycaemic control improved in both groups, but there was no statistical difference between either group. Total daily insulin dose reduced significantly in the low carbohydrate group, but, unlike in Sweden, glycaemic control, as measured by continuous glucose monitoring and HbA1c, did not improve.[10]

FINAL THOUGHTS

This area of research is desperately lacking at present. As healthcare professionals, it is of paramount importance that we are equipped with scientifically sound, evidence-based guidelines to advise our patients on how to follow a low carbohydrate diet correctly and safely. The experiences of those involved in the trials discussed, Dr Bernstein, Dr Stapleton, Lewis Civin and Vinnie Santana, are only the tip of the iceberg, and I have no doubt that this topic will continue to be debated and explored over the next number of years.