Carbohydrate counting: A locally developed structured education course in Liverpool

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Article points

1. NICE guidelines for people with type 1 diabetes now recommend all adults with type 1 diabetes be offered carbohydrate counting education that fulfils NICE structured education guidelines.

2. A locally developed 4-day course on carbohydrate training has been rolled out in Liverpool.

3. The course appears to lead to a reduction in HbA$_{1c}$ at 3 months and this reduction is maintained at 6-months post-course in the group studied.

Key words

- Carbohydrate counting
- Insulin dose adjustment

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Recent NICE guidance has suggested that all adults with type 1 diabetes should be offered training in carbohydrate counting and insulin dose adjustment. Following an unsuccessful bid to set up a DAFNE (Dose Adjustment for Normal Eating) course in the local area, the authors decided to develop a similar training course focusing on adults with type 1 diabetes. In line in previous research in this area, this study looked at the change in HbA$_{1c}$ levels following a 4-day carbohydrate counting course.

Over the past decade, the *Journal of Diabetes Nursing* has published a number of articles discussing carbohydrate counting and insulin dose adjustment, and the structured education programmes available. The role of carbohydrate counting and its effect on diabetes control and quality of life is well known. Since the publication of the type 1 NICE guidelines NG17 (NICE, 2015), centres who do not provide structured education for people with type 1 diabetes have been encouraged to better support this group of people and consider how best to address the "education" gap.

History

Carbohydrate counting is not a few technique; it has been around for decades. In fact, the concept has been in use since the 1920s, when insulin was first discovered (Joslin, 1927). Initially, carbohydrate counting was inflexible and was more of a "carbohydrate prescription" to match fixed doses of biphasic insulin. There was no flexibility in carbohydrate or insulin dose. In the 1990s, recommendations changed and it was suggested that the same healthy balanced diet that was recommended to the general population should also be that followed by people with diabetes. As such, carbohydrate counting was no longer generally recommended (American Diabetes Association, 1987; British Dietetic Association, 1992).

In the late 1990s, however, many diabetes teams were unhappy with the outcomes for people with type 1 diabetes and looked for evidence to improve practice, education and outcomes. At the time, a successful education course was being run in Dusseldorf, Germany for people with type 1 diabetes, which showed evidence of improved control and reduced episodes of hypoglycaemia. It was so successful that the course had been adopted in other European countries (Pieber et al, 1995). The rest, as they say, is history. DAFNE (Dose Adjustment For Normal Eating) was born and showed similar improvements when evaluated in the UK (DAFNE Study Group, 2002). Carbohydrate counting was making a comeback, but not as we knew it!

Carbohydrate counting with flexible insulin dose adjustment due to more predictable and sophisticated insulins enables people with

diabetes to match insulin doses to the amount of carbohydrate eaten rather than having to eat prescribed amounts of carbohydrate to match fixed insulin doses. Structured education programmes such as DAFNE (Dose Adjustment for Normal Eating) and BERTIE (Bournemouth Type 1 Intensive Education; Everett et al, 2003) emphasised self-management skills and empowerment during group education while also teaching carbohydrate counting. This was supported with evidence from DAFNE randomised controlled trials, showing that carbohydrate counting improves glycaemic control without increasing episodes of hypoglycaemia or weight gain, as well as improving quality of life and general wellbeing (DAFNE study group, 2002; Everett et al, 2003).

New nice guidelines

NICE guidelines for people with type 1 diabetes now recommend all adults with type 1 diabetes be offered carbohydrate counting education that fulfils NICE structured education guidelines (NICE, 2015). See *Box 1*.

Locally developed carbohydrate counting courses

Many locally developed courses do not publish patient outcomes (this is my assumption, as of the 86 locally developed courses in the UK, a literature search on outcomes of such courses returned a much lower number of publications; Clark, 2008; Lowe et al, 2008). There is, however, evidence that locally developed courses both within and outside of the UK for carbohydrate counting have a positive impact on patient outcomes (Kinch et al, 2004; Clark, 2008; Lowe et al, 2008, Laurenzi et al, 2011; Hermanns et al, 2013).

Our journey

After unsuccessfully applying for funding to run a DAFNE course in Liverpool, the diabetes team decided to set up a home-grown course. The course would need to comply with the NICE structured education guidance (NICE, 2015) and mirror the evidence-based courses available. Much support was provided from

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Box 1. NICE recommendations for structured education (NICE, 2015).

Offer all adults with type 1 diabetes a structured education programme of proven benefit, for example the DAFNE (dose-adjustment for normal eating) programme. Offer this programme 6–12 months after diagnosis.

1.3.2 If a structured education programme has not been undertaken by an adult with type 1 diabetes by 12 months after diagnosis, offer it at any time that is clinically appropriate and suitable for the person, regardless of duration of type 1 diabetes.

1.3.3 Provide an alternative of equal standard for any adult with type 1 diabetes unable or unwilling to participate in group education.

1.3.4 Ensure that any structured education programme for adults with type 1 diabetes includes the following components:
- It is evidence based, and suits the needs of the person.
- It has specific aims and learning objectives, and supports the person and their family members and carers in developing attitudes, beliefs, knowledge and skills to self manage diabetes.
- It has a structured curriculum that is theory driven, evidence based and resource effective, has supporting materials, and is written down.
- It is delivered by trained educators who have an understanding of educational theory appropriate to the age and needs of the person, and who are trained and competent to deliver the principles and content of the programme.
- It is quality assured, and reviewed by trained, competent, independent assessors who measure it against criteria that ensure consistency.
- The outcomes are audited regularly.

The Diabetes Education Network (http://www.diabetes-education.net) and the Liverpool Carbohydrate Counting and Insulin Dose Adjustment Course was born. The course runs in a similar way to BERTIE (Everett et al, 2003) – one afternoon per week over 4 weeks. The course content is very similar to the aforementioned evidence-based courses and every session is attended by diabetes specialist nurses and a diabetes specialist dietitian.

The course was initially run 6 times per year, with a maximum intake per course of 6 people with type 1 diabetes. We were surprised to find that the evening course was not very popular and therefore, it is now only run once per year.

Over the past 3 years, and noticeably since the publication of the new NICE guidelines (NICE, 2015), the referral rate for the course has increased. We are now running the course 8 times per year with 8 attendees. This has significantly increased the available places, but still gives us only 64 places per year. In order

to free up places for those individuals who have never received any carbohydrate counting training, we have now developed a refresher course for those people who have done the training before and only need an update.

Feedback from attendees has been very positive to date and many attendees have also contributed to developments within the course and to the development of the refresher course. We are fortunate that the dropout rate for the course is less than 10%. People who drop out after the first session often re-book for a future course and the most common reasons for dropping out are problems getting time off work and illness.

The service is now at a point where further courses will require additional staff hours. For this reason, the team decided to look at more biomedical outcomes in order to support a bid to run a course every month, increasing available places to 96 per year (a 50% increase on our current provision) and also allow for some additional administrative support.

The diabetes team are also currently gathering the evidence to achieve QISMET (Quality Institute for Self-Management Education and Training) certification (QISMET, 2016). Once certified, we will have evidence that the course meets the quality standard for diabetes structured education, which will increase its credibility when approaching the clinical commissioning group or local healthcare trusts to expand provision.

Carbohydrate counting and HbA_{1c}

There have been a number of observational studies and several RCTs to see the effects of carbohydrate counting on clinical indicators such as HbA_{1c} (Bell et al, 2014; Schmidt et al, 2014). Overall, the studies demonstrated a positive trend in HbA_{1c} improvements; however, the currently available literature does not provide sufficient evidence to definitively determine the effects.

Evaluation of our carbohydrate counting course has been ongoing, with standard post-course evaluation sheets. Feedback has always been positive, with people regularly citing "discussing diabetes with other people

with type 1 diabetes" as one of the most valuable parts of the course, along with "a greater understanding of their diabetes". Outcome measures such as reduction in HbA_{1c} have not been reviewed until recently.

HbA_{1c} analysis for the past 2 years

Our aim was to determine if attendance at our carbohydrate counting course in an inner-city hospital led to improvements in HbA_{1c} in people with type 1 diabetes who attended all four sessions.

Using the carbohydrate counting course database, individuals with type 1 diabetes who had completed all four sessions of the course over a two-year period had their baseline HbA_{1c} compared with HbA_{1c} taken 3 and 6 months post course. Of the 50 people who completed all four sessions, 36 (72%) had a baseline and 6-month post course HbA_{1c}. Those who had HbA_{1c} tested at both 3-months and 6-months post course were compared to determine whether there was any improvement, maintenance or worsening in the months after the course.

Results

Fifty people were included in this review (56% male and 44.% female). The mean age was 47±14.7 years and mean duration of diabetes diagnosis was 20.5±15.2 years.

The mean baseline HbA_{1c} pre course was 73 mmol/mol (8.8%) and the reduction in HbA_{1c} was statistically significant between baseline and 6-month check (73 mmol/mol [8.8%] versus 68 mmol/mol [8.4%]; $P=0.005$). A similar reduction in HbA_{1c} was seen in those with a 3-month HbA_{1c} level (73 mmol/mol [8.8%] versus 69 mmol/mol [8.5%]; $P=0.001$).

In the 21 individuals who improved their HbA_{1c} at 6 months, the mean reduction was 14.5 mmol/mol (18% reduction), with a mean baseline HbA_{1c} of 80.2 mmol/mol (9.5%) and a mean 6-month HbA_{1c} of 65.7 mmol/mol (8.2%; *Table 1*).

The 11 individuals with an increased HbA_{1c} at 6 months had a mean baseline HbA_{1c} of 65.2 mmol/mol (8.1%) and a mean 6-month HbA_{1c} of 72.2 mmol/mol (8.8%). See *Table 1*.

Discussion

Overall studies from the literature search have demonstrated a reduction in HbA_{1c} after introduction of carbohydrate counting and flexible insulin dose adjustments.

Analysis of HbA_{1c} levels in this study and the resulting reduction mirrored the reductions seen in the DAFNE and BERTIE studies (Everett, 2003; Cooke 2013). Therefore, our study appears to be having a similar effect on HbA_{1c} in our attendees as the nationally recognised and recommended courses.

A review into the effectiveness of carbohydrate counting in 2014 identified seven eligible trials, comprising 599 adults and 104 children with type 1 diabetes (Bell et al, 2014). Overall, there was no significant improvement in HbA_{1c} concentration with carbohydrate counting versus the control or usual care; however, they identified five studies in adults with a parallel design, and noted there was a 0.64% point (7.0 mmol/mol) reduction in HbA_{1c} with carbohydrate counting versus control. This is a very similar reduction to that found in our review.

While people with type 1 diabetes appear motivated to use carbohydrate counting and a flexible insulin adjustment regimen, one study did show that people expressed a need for continued health professional input, particularly to support adjustment of background insulin doses and mealtime ratios

(Lawton et al, 2012). This may be pivotal for continued or sustained improvement in diabetes control. Another study by Rankin et al (2011) showed that carbohydrate counting tended to be more successful in people who had more stable routines and more difficulties were expressed by those who worked irregular hours or who had irregular eating patterns, and who made little changes in these patterns. This may go some way to explain why the course is more successful in improving HbA_{1c} in some people than in others.

Benefits of the reduction in HbA_{1c} are well documented; for every 10% reduction in HbA_{1c}, there is a marked reduction in complications over time. Some evidence also suggests that the sooner this reduction occurs in the person's life with diabetes, the greater the benefits (Diabetes Control and Complications Trial [DCCT], 1995) and also more cases of complications are prevented by the same degree of improvement in glycaemic control at higher levels of HbA_{1c} (Molyneaux et al, 1998). With this in mind, encouraging carbohydrate counting and flexible dose adjustment in people with type 1 diabetes early on in their diagnosis may be key to achieving improvements in HbA_{1c} as early as possible. Looking into the reasons why people with type 1 diabetes are not referred for carbohydrate counting earlier is key. In our study, surprisingly, the average age of people attending the course was 47 years and average

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1. Analysis of HbA_{1c} levels in this study and the resulting reduction mirrored the reductions seen in nationally available structured education courses.

2. Encouraging carbohydrate counting and flexible dose adjustment in people with type 1 diabetes early on in their diagnosis may be key to achieving improvements in HbA_{1c}.

Table 1. Mean HbA_{1c} pre- and post-course attendance.				
Number of course attendees	**Mean pre-course HbA_{1c} (mmol/mol)**	**Mean post-course HbA_{1c} (mmol/mol)**	**Mean difference in HbA_{1c}**	**% change**
36 (total)	73	68	5 (P=0.005)	7% reduction
21 (59%) reduced HbA_{1c}	80	66	14	18% reduction
11 (31%) increased HbA_{1c}	65	72	7	10% increase
4 (10%) no change in HbA_{1c}	63	63	0	0%

"Carbohydrate counting is an important part of managing type 1 diabetes; however, the currently available literature does not provide enough evidence to definitively determine effects on clinical parameters, such as HbA$_{1c}$."

duration of diabetes was 20.5 years. More work has to be done to make the course inviting to those of a younger age group and to people earlier on in their diagnosis. Some work needs to be done to establish if the young adult population locally need a different carbohydrate counting education process in order to increase uptake and development of this skill.

Conclusions

Carbohydrate counting is an important part of managing type 1 diabetes; however, the currently available literature does not provide enough evidence to definitively determine effects on clinical parameters, such as HbA$_{1c}$. Our carbohydrate counting course appears to lead to a reduction in HbA$_{1c}$ at 3 months and this reduction is maintained at 6-months post-course in the group studied. This is a locally developed course, but does follow similar learning objectives as the nationally recognised courses. One may conclude from this that locally developed courses can bring about similar outcomes as the nationally recognised courses DAFNE and BERTIE. It is important, however, that in the future steps are taken to attract younger people with type 1 diabetes and those earlier on in their diagnosis to these courses. ■

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