Understanding the relationship between type 1 diabetes and diet

Gaynor Bussell

Type 1 diabetes was once referred to as juvenile onset diabetes as it was thought to begin in childhood or the early teenage years. However, it is now known to develop at any age, although most often affecting those under 40 (Norman, 2015). About 10–20% of adults with diabetes have type 1 (Diabetes UK, 2012a).

Type 1 diabetes is believed to develop as a result of the immune system attacking its own insulin producing beta cells in the pancreas, where the hormone insulin is produced (Hober and Sauter, 2010). This may be triggered by a virus or other infection — genetics may also be a factor.

The condition is different from type 2 diabetes, which mainly results from poor diet, lack of physical activity, excessive weight gain and genetics/family history. However, the manifestation of type 1 diabetes can be similar to that of type 2 as a result of excessive levels of glucose circulating in the blood stream.

Symptoms of type 1 diabetes typically include thirst, tiredness and weight loss, due to glucose being washed out in the urine as it is unable to be used by the body without insulin — if untreated, this can lead to ketoacidosis and eventually coma (Medline Plus, 2015a). Treatment involves insulin therapy as diet alone cannot normalise the blood sugars. The aim of treatment for people with type 1 diabetes is to keep the sugar levels in the blood within a normal range. Carbohydrates are broken down into sugar where they enter the bloodstream in the form of glucose, acting as an energy source. The pancreas then produces insulin, which acts upon the glucose so that it can enter the body’s tissues. However, when insulin levels are high after meals, excess glucose is stored in the liver (glycogen). Between meals when insulin levels are low, the liver releases glycogen into the bloodstream as a sugar. If the pancreas secretes too little insulin (type 1 diabetes), or the body doesn’t produce enough insulin or is resistant to its action (type 2 diabetes), the level of sugar in the bloodstream increases as it cannot enter the cells. High blood sugar can lead to blindness, nerve damage and kidney damage.

Source: Mayo Clinic: www.mayoclinic.org

KEYWORDS:
Diabetes ■ Nutrition ■ Carbohydrate counting ■ Glycaemic index

Table 1: Blood sugar levels recommended by NICE (2004)

<table>
<thead>
<tr>
<th>Target levels by type</th>
<th>Before meals (pre-prandial)</th>
<th>Two hours after meals (post-prandial)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-diabetic</td>
<td>4.0–5.9 mmol/L</td>
<td>Under 7.8 mmol/L</td>
</tr>
<tr>
<td>Type 1 diabetes</td>
<td>4–7 mmol/L</td>
<td>Under 9 mmol/L</td>
</tr>
<tr>
<td>Children with type 1 diabetes</td>
<td>4–8 mmol/L</td>
<td>Under 10 mmol/L</td>
</tr>
</tbody>
</table>

Gaynor Bussell, freelance dietitian and public health nutritionist
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diabetes is to keep the blood sugars to defined levels (Table 1) (National Institute for Health and Care Excellence [NICE], 2004).

Hypoglycaemia (triggered when blood sugar levels fall under 4mmol/L) is a real risk when too much insulin is used or too little food is taken in, so community nurses should advise patients to avoid their blood sugars plummeting too low, especially at night (NICE, 2004).

Patients with diabetes should also be advised on how many tests to carry out each day, with the aim of checking whether their blood sugars are being maintained at the required level (Table 1).

**CARBOHYDRATE COUNTING**

Although the amounts of other nutrients in the diet can affect blood sugar levels to some degree, the amount of carbohydrates consumed has the most significant effect.

However, over the years the advice about how to ‘count’ or monitor carbohydrate intake has almost come full circle. The favoured approach is now to adjust the amount of insulin required against the individual’s diet (Wylie-Rosett, 2013; Schmidt et al, 2014), ensuring as much flexibility as possible so that the person with type 1 diabetes can eat a varied amount of carbohydrates from meal to meal.

With the help of a qualified dietician, the individual with type 1 diabetes would work out the ratio of insulin he or she needs to take versus the amount of carbohydrates consumed. Typically, this ratio will be worked out for the number of insulin units per 10g of carbohydrate.

For this reason, people with type 1 diabetes need to know the carbohydrate value for the foods they eat and there are many carbohydrate-counting tables available (Diabetes Education Scotland, 2015). Patients should also be told that the ratio of carbohydrates to insulin can vary from meal to meal, under circumstances such as illness, stress, and overactivity/exercise, and depending on the most recent blood sugar reading.

Patients should also be shown how to work this out for themselves and there are now special blood glucose monitors that, once pre-programmed, will indicate how much insulin is required for each dose of carbohydrate consumed.

The machine takes into account the current reading and will advise if extra bolus doses (a ‘bolus’ refers to a single dose of insulin) are needed when blood sugar levels are high. If blood sugars are low, the machine will advise the patient to take some quickly absorbed carbohydrate.

If an individual is receiving insulin via a pump, then all the information will be calibrated into the machine and he or she will be instructed on how much insulin to give according to the blood glucose reading (NICE, 2008).

Special advice is also needed in illness such as ‘flu’, which can cause a rise in blood sugar levels as well as suppressing the appetite. When they are ill, there are two things that can happen to people with type 1 diabetes:

- They may not eat properly, so if they have taken insulin they may become hypoglycaemic without adequate carbohydrate
- Blood sugars tend to rise during illness and unless this is properly compensated for with insulin it can give rise to excess ketone production as the body starts using its own fat reserves.

Overall, it is best for an unwell person with type 1 diabetes to have some carbohydrates in the form of a glucose drink, followed by an injection of insulin (maybe slightly more than usual to compensate for the illness).

**Table 1**: Percentage risk of hypoglycaemia (National Diabetes Centre, 2008; Rosett, 2013; Schmidt et al, 2014), against the individual’s diet (Wylie-Rosett, 2013; Schmidt et al, 2014).

**Table 2**: Glycaemic index (GI) ranking of common foods

<table>
<thead>
<tr>
<th>Low glycaemic index (GI=55 or less)</th>
<th>Medium glycaemic index (GI=56–69)</th>
<th>High glycaemic index (GI=70 and above)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweet potatoes</td>
<td>Basmati rice</td>
<td>Rice (white and brown)</td>
</tr>
<tr>
<td>Pasta</td>
<td>New potatoes</td>
<td>Potatoes (baked, mashed, chipped)</td>
</tr>
<tr>
<td>Muesli, porridge, All-Bran®, Sultana-Bran,</td>
<td>Weetabix®, shredded wheat</td>
<td>Corn Flakes®, Rice Krispies®, Cheerios®, puffed wheat</td>
</tr>
<tr>
<td>Breads — rye, granary, wholegrain, sour dough, fruit bread</td>
<td>Pitta bread, scone, wholegrain crispbread</td>
<td>White bread, French bread, crisp bread, crumpets, wholemeal/ brown bread</td>
</tr>
<tr>
<td>Fruit, vegetables, fruit juice, dried fruit, baked beans</td>
<td>Melon</td>
<td>Broad beans, swede</td>
</tr>
<tr>
<td>Milk, soya milk, fromage frais, yoghurt, custard</td>
<td>Ice cream®, lower fat ice cream, rice pudding*/lower fat rice pudding</td>
<td></td>
</tr>
<tr>
<td>Chocolate*</td>
<td>Crisps®, fizzy drinks®, digestive/ oat biscuits®, rich tea biscuits®, jam®, honey®, marmalade®</td>
<td>Jelly beans/babies, Lucozade</td>
</tr>
</tbody>
</table>

*Regardless of GI, the foods with an asterisk are high in fat/low in nutrients and so should only be eaten occasionally.
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If working out the amount of insulin for each meal is considered to be too challenging for a particular patient, then advice on eating regularly, with roughly the same amount of carbohydrates (e.g. the same amount of bread at lunch time or potatoes in the evening) may be the best advice. The Diabetes UK website provides structured programmes that teach about carbohydrate counting (Diabetes UK, 2012b).

**Types of carbohydrate**

The type and quantity of carbohydrates in the diet is an important consideration for people with diabetes. Evidence suggests that carbohydrates should constitute approximately 50% of a person’s calorie intake (Norman, 2014), but that no more than 10% of a person’s energy intake (the total calories obtained from food) should be sugars (also a carbohydrate), which equates to a person consuming a total of no more than 90g of sugars per day.

This is the current UK guideline for healthy eating in the general population and also applies to people with diabetes (Department of Health [DH], 1991). Those with type 1 diabetes can cut their sugar intake by half, but their total carbohydrate intake should remain at 50% — this means that more of the carbohydrates need to come from non-sugar sources such as bread, pasta, etc. In the past it has been suggested that people with diabetes, and indeed the general population, should eat fewer carbohydrates. However, current advice states that people with diabetes stick to the original advice and take 50% of their calories as carbohydrates (Diabetes UK, 2012c).

**THE GLYCAEMIC INDEX**

The glycaemic index (GI) is also a consideration in type 1 diabetes. This is a measure of how fast carbohydrates are broken down and released into the bloodstream as glucose. Glucose itself is given a GI of 100, with all other starchy and sugary foods given a value relative to this, i.e. pasta is released 40% slower than pure glucose and consequently has a GI of 40 (Table 2). Slower-release carbohydrates (with lower GIs) are believed to be better for people with diabetes as they avoid high sugar ‘spikes’ and lead to improved blood sugar control — they are also believed to help with satiety so that people do not get hungry as quickly between meals (Bussell, 2014).

One randomised controlled trial (RCT) of 14 studies (including six on type 1 diabetes) showed that following a low GI diet improved long-term control of HbA1c (Brand-Miller et al, 2003). Most well-established authorities on diabetes now recommend a combination of carbohydrate counting and a low GI diet for maintenance of type 1 diabetes (Dyson et al, 2011; Marsh et al, 2011; American Diabetes Association, 2014).

Where possible, carbohydrates should be wholegrain — this is not just because they are likely to have a lower GI, but also because wholegrain cereals are higher in fibre and are associated with protection from cardiovascular disease (Giacco et al, 2014).

**HEALTHY EATING**

For people with type 1 diabetes, the aim is to eat a normal healthy diet. Therefore, as well as being aware of the carbohydrate count of foods and their GI, community nurses need to advise patients to avoid excessive saturated fat and salt intake, take plenty of fibre and include adequate amounts from each of the food groups: protein, dairy, fruit and vegetables and starchy foods (for guidance on the amounts of each needed for a healthy diet, visit: www.nhs.uk/livewell/goodfood/pages/eatwell-plate.aspx).

This kind of healthy diet is more likely to keep blood sugar levels in line and help to meet the targets for blood pressure, cholesterol, etc recommended for people with type 1 diabetes. In turn this helps reduce the incidence of diabetic complications, such as kidney disease and eye problems, as well as the risk of cardiovascular disease (Lithovius et al, 2014).

**WEIGHT**

Before receiving a diagnosis, many people with type 1 diabetes will have lost some weight (Medline Plus, 2015b), and in some cases will actually be underweight. Weight loss can also be a sign that diagnosed diabetes is not being well controlled. However, once insulin therapy is started, the patient should begin to regain weight providing his or her diet is adequate. Some people with diabetes find it hard to control their weight as insulin does promote weight gain. Cutting 500–600kcal from the diet will lead to a weight loss of approximately 1kg per week, which is a good rate. In the author’s clinical experience, any higher rate of weight loss can be detrimental and is not recommended unless the patient is under close medical supervision.

If the person with type 1 diabetes does begin to cut down on food, this should be done proportionally so that 50% of the diet still comes from carbohydrate. However, it is important that the patient is careful to adjust the insulin dose to match any new weight-loss regimen. People with type 1 diabetes, as in the general population, gain weight as a result of eating too many high-fat foods such as cakes, pastries, pies, biscuits and crisps — if weight loss is required these foods need to be kept to a minimum (Delahanty and McCulloch, 2015). Fats have twice as many calories ‘gram-for-gram’ as proteins or fats, therefore, even with ‘healthier’ fats such as olive oil or oily fish it is important to monitor portion sizes.

**GESTATIONAL DIABETES**

Sometimes the strain of pregnancy — particularly when coupled with being overweight or obese — means that the pancreas cannot cope with the body’s increasing demands for insulin. This is known as gestational diabetes and it affects approximately 5% of pregnant women (Diabetes UK, 2010). Pregnancy can also exacerbate the symptoms of existing type 1 diabetes.

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important to keep the levels of glucose in the mother’s blood under control. In most cases, gestational diabetes develops in the second half of pregnancy and disappears after the baby is born. However, if gestational diabetes is present throughout a pregnancy, then it is important for the mother to keep her weight down following the birth as there is an increased risk that she will go on to develop type 2 diabetes (Mudalige et al., 2014).

Blood glucose target levels are ‘tighter’ in women with gestational diabetes and not the same as those for women with type 1 or type 2 diabetes. New guidance from NICE recommends that a woman should be diagnosed with gestational diabetes if she has either a fasting plasma glucose level of 5.6mmol/litre or above, or a two-hour plasma glucose level of 7.8mmol/litre or above, one hour after eating (NICE, 2015).

CONCLUSION

Type 1 diabetes requires insulin for treatment. This needs adjusting for each individual and according to the amount of carbohydrate eaten for each meal. It is important that community nurses have some knowledge of this in case they come across patients with type 1 diabetes in their practice.

Most people with type 1 diabetes are advised to work out their own ratio for the amount of carbohydrates-to-insulin required, and there is evidence that it is best for them to eat carbohydrates that have a low glycaemic index and release glucose slowly. It is also particularly important that people with type 1 diabetes follow healthy eating guidelines and keep their weight within a ‘normal’ range. This will help to improve control of their condition and reduce the risk of cardiovascular disease and other diabetic complications.

REFERENCES

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## Programme  Thursday 30 April 2015

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<th>Session</th>
<th>Speaker/Presenter</th>
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<tbody>
<tr>
<td>0900 – 0925</td>
<td>Coffee and registration</td>
<td></td>
</tr>
<tr>
<td>0925 – 0930</td>
<td>Introduction and welcome</td>
<td>Louise Toner, Associate Dean, Birmingham City University</td>
</tr>
</tbody>
</table>
| 0930 – 1015 | Wounds – prevention, assessment and management                                                              | Richard White, Professor, University of Worcester  
Director, Plymouth Wound Care                                                                         |
| 1015 – 1100 | Skin Tears and Minor Traumatic Wounds – prevention, assessment and management                               | Jackie Stephen-Haynes, Professor and Consultant Nurse in Tissue Viability,  
Birmingham City University and Worcestershire Health and Care NHS Trust                                |
| 1100 – 1130 | Coffee and exhibition viewing                                                                                |                                                                                                         |
| 1130 – 1215 | Leg Ulcers – prevention, assessment and management                                                          | Jeanette Milne, Tissue Viability Specialist Nurse,  
South Tyneside NHS Foundation Trust                                                                     |
| 1215 – 1300 | Wound Dressings                                                                                              | Menna Lloyd Jones, Independent Tissue Viability Specialist                                               |
| 1300 – 1400 | Lunch and exhibition viewing                                                                                 |                                                                                                         |
| 1400 – 1445 | Pressure Ulcers – prevention and management                                                                | Julie Evans, TV Nurse, Abertawe Bro Morgawwng University Health Board,  
Swansea                                                                                                 |
| 1445 – 1530 | Essential Skin Care                                                                                         | Rosie Callaghan, Tissue Viability Specialist Nurse, Worcestershire Health and Care NHS Trust             |
| 1530 – 1615 | Implementing Care with Care Studies – interactive session                                                  | Jackie Griffin, TV Clinical Nurse Specialist, Powys Teaching Health Board                               |
| 16.15   | Quiz, prizes and close                                                                                      |                                                                                                         |

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