



InDependent Diabetes Trust

Carbohydrates

Updated January 2013



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What are carbohydrates?

Carbohydrates are sugars and starches – bread, potatoes, rice, pasta, cereals and sugars. They provide the energy our bodies need for its various activities. Energy is also supplied by fats we eat.

What happens to the carbohydrates we eat?

In people without diabetes:

- When we eat, beta cells in the pancreas produce insulin, a hormone which controls the glucose levels in the blood.
- The pancreas produces the right amount of insulin for the amount of carbohydrates we have eaten and this keeps the level of glucose in the blood within the normal range. [People WITHOUT diabetes always have blood glucose levels within certain measurements.]

- The carbohydrates are converted into glucose which then goes into the blood and is carried around in the blood vessel system. It is taken to all parts of the body to provide energy wherever it is needed.
- Glucose is fast acting and always present in the blood.
- If we have eaten more carbohydrates than we need for energy at a particular time, then the excess glucose is stored in the liver. This is used for emergencies such as extra physical activity, or occasions when the blood glucose levels drop unexpectedly, such as times of fear.

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What happens in people with Type 1 diabetes?

- In people with diabetes, the cells in the pancreas cannot produce insulin. When carbohydrates are eaten, no insulin is produced and so the glucose levels in the blood rise higher and higher.
- The body cannot cope with this and so the excess glucose is passed through the body into the urine. This means that people with untreated diabetes pee a lot to get rid of the excess glucose. In turn, this makes them thirsty because the body gets dehydrated. These are the classic signs of undiagnosed diabetes – thirst and peeing.
- The body becomes short of energy as a result of the glucose being excreted and the person feels tired. The body starts to burn fats to provide the necessary energy and there is weight loss. Treatment is essential at this stage and it is often an acute emergency situation.

Treatment of Type 1 diabetes

As the body does not produce its own insulin, the treatment of Type 1 diabetes is always giving insulin by injections. This means that the insulin is given in regular doses and not in response to the carbohydrates eaten so the insulin has to be balanced with the amount of food eaten and the level of activity / exercise.

What happens in people with Type 2 diabetes?

- In Type 2 diabetes, the body either does not produce enough insulin or the insulin produced cannot be used properly by the body [insulin resistance]. So when carbohydrates are eaten, the levels of glucose in the blood rise.
- As some insulin is produced, usually the blood glucose levels do not rise as high as in Type 1 diabetes and so there may be no symptoms for many years and Type 2 diabetes can remain undiagnosed.

Treatment of Type 2 diabetes

Initially this could be diet only, diet and tablets and if this does not keep the blood glucose levels sufficiently low, then insulin treatment becomes necessary. There are different types of tablets that either stimulate the pancreas to produce more insulin or increase the body's sensitivity to insulin so that it is used more effectively.

Although Type 1 and Type 2 diabetes are different conditions, the treatment of both involves balancing insulin, or medication, with diet and exercise. The aim is to try to achieve as near normal blood glucose levels as possible or to achieve the target blood glucose levels set for you by the diabetes team.

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The recommended diet

The recommended diet these days for people with diabetes is the standard high carbohydrate, low fat, plenty of fruit and vegetables, that is the 'healthy diet' recommended for the general population. Prior to 1986, the recommended diet for people with both types of diabetes was a restricted carbohydrate diet. In people with Type 1 diabetes, this involved matching the insulin dose to the amount of carbohydrates eaten and many people have continued to follow this

diet. Some people also follow a low carbohydrate diet which results in lower doses of insulin being necessary which in turn results in less variable blood sugars and less weight gain. Despite a resistance to the low carb diet on the part of many health professionals, there is now evidence that a low carbohydrate may be beneficial for people with Type 2 diabetes.

However, as well as the amount of carbohydrate eaten being important, the type of carbohydrate is also important.

Different types of carbohydrate

Quick-acting carbohydrates

Some carbohydrates are quick acting eg sweet foods such as cakes, puddings, chocolate. Sugary foods will raise blood sugars more quickly and higher in people with diabetes and more injected insulin or medications may be necessary. Sugary carbohydrates tend not to last as long in the body so blood sugars may drop before the next meal. Sugary carbohydrates tend to make blood glucose levels peak and trough.

Slow-acting carbohydrates

Some carbohydrates are slower acting and last longer eg bread, potatoes and high fibre cereals. These carbohydrates do not raise the blood sugars as quickly or as high after eating. They last longer and therefore tend to give more even blood glucose levels. The amount of insulin, or in Type 2 diabetes, medication needed may be less if sugary foods are avoided and the diet is made up of slower and longer-acting carbohydrates.

For people with diabetes, the slower acting carbohydrates are better because they last longer and do not give sharp rises in blood glucose levels.

Measurement of blood glucose levels

Regular measurement of blood glucose levels is the way people with diabetes know what is happening to their blood sugars and whether they need to make any adjustments to their food intake or insulin dose. Urine testing used to be done and still is in some cases. Blood tests give accurate readings of the blood glucose level at that particular moment whereas urine testing actually measures urine that could have been in the bladder for a couple of hours.

Normal blood glucose levels in someone WITHOUT diabetes are between 4 and 7mmols/l. Most people with diabetes are encouraged to try to keep their blood glucose levels as near to normal as possible.

High blood glucose levels [hyperglycaemia]

Blood glucose levels that are too high can occur for several reasons:

- If there is not enough insulin for the amount of carbohydrate eaten.
- If the amount of exercise is less than normal and so the glucose in the blood is not used up.
- When there is an illness, cold or 'flu. They often rise before an illness so high sugars can be a sign that a cold or illness is 'brewing'.
- Stress.
- Sometimes for no apparent reason at all!

High blood sugars can and do occur and the odd high is not unusual. The symptoms and signs of more prolonged high blood glucose levels are similar to those of the undiagnosed state, although not usually as severe unless the highs are present for some days. If this is the case and blood sugar readings are high for a prolonged period, then medical advice is necessary. Many people with diabetes treated with insulin will increase their dose of insulin to deal with this situation, without consulting the doctor or nurse.

Low blood glucose levels [hypoglycaemia]

This is when the blood sugar levels are too low. For whatever reason, there is too much insulin present for the amount of food eaten and this situation needs treatment immediately with a sugary drink, sugary food or glucose tablets.

Hypoglycaemia [often referred to as hypos] occurs for several reasons:

- The amount of insulin given was too great.
- Extra energy has been used by extra activity without eating extra food. The glucose in the blood has been used up and so it drops below normal.
- Fear anxiety, excitement, stress and various emotions.
- For no apparent reason at all!

Note: Hypoglycaemia is caused by the treatment of diabetes and not by diabetes itself. People taking insulin are at risk of hypoglycaemia but only some of the medications for the treatment of Type 2 diabetes cause hypos.

Hypo warning signs

Most people have warning signs of the blood glucose level dropping below normal. This often happens just before a meal or after unexpected exercise. They are usually aware of these themselves although quite often carers and family members recognise the signs earlier. There are classic warning signs but these may vary from person to person or may vary at different times in the same person, but generally they are as follows:

- Feeling weak
- Trembling or shaking
- Pallor
- Blurring of vision
- Hunger
- Confusion
- Aggression/change in behaviour or mood.

Treatment of hypos

- Quick-acting carbohydrate in the form of a sugary drink or sugary food. This can be seen as a time to eat the foods that are normally restricted eg cakes, chocolate etc.
- This should then be followed by some long-acting carbohydrate such as a wholemeal bread sandwich.
- If the hypo remains untreated then the blood sugars drop even further and this can lead to coma which, in some people, may be accompanied by a seizure.

There is a golden rule about hypos. If you are unsure whether or not someone is hypo, then **FEED**. If this is a misjudgment and results in a high blood sugar, this will not be harmful but leaving a hypo untreated could result in the blood sugar dropping even further and eventual coma. It is common for the person with diabetes to deny they are hypo and refuse food – ignore this!

The Carbohydrate Question Revisited

High, low or restricted carb diets?

In 1986 the UK government issued dietary guidelines for the general population recommending the high carbohydrate/low fat diet to reduce the risks of heart disease. Diabetes experts followed suit in recommending this diet for people with diabetes. Nearly twenty years later, we have a population that is more obese and overweight than ever before and the incidence of Type 2 diabetes is greater and growing at frightening speed. People with Type 2 diabetes are using more combinations of anti-diabetic drugs, anti-cholesterol and anti-hypertensive drugs and people with Type 1 diabetes are having more daily injections, larger daily intake of insulin to cope with higher carbohydrates and also many of the drugs described above.

While fully accepting that in the last 20 years lifestyles have become more sedentary with people taking less exercise, have people with

diabetes really benefited in any way from the high carb/low fat diet? If so, it's hard to see where!

So what happened to people with diabetes before 1986? They had a restricted carbohydrate diet and counted carbs. How did we do it? We had a book, 'Carbohydrate Countdown' that listed the carb values of every food imaginable.

For some us with diabetes this new high carb diet never has made sense! A high carb intake will push blood sugars up high and for people using insulin, this then requires higher doses of insulin. If lower amounts of carbohydrate are consumed, then smaller insulin doses are required. Lower doses of insulin result in more predictable blood sugars, less hypoglycaemia and less weight gain. Many people who have had diabetes a long time never changed to the high carb/low fat diet and stayed with carb counting and restricted their carb intake. Contrary to popular belief, this does not mean that this diet has to be high in bad fats!

Despite this, it is almost heresy to suggest that a low or restricted carbohydrate diet may be a better option. People using insulin pumps are now taught to carb count and it is difficult to understand why this is sensible for people using a pump but not for people using insulin injections.

There is now evidence that people with Type 2 diabetes can benefit from low carb diets and the American Diabetes Association has now added this to their Dietary Guidelines.

The following article is by Katharine Morrison, a GP and mother of a 13 year old son with Type 1 diabetes. In initial discussions with Katharine she made the point that it is surprising that there is not more interest in promoting a diet that does all of these:

1. Prolongs honeymoon phase in type ones.
2. Prolongs pancreatic function in type twos.
3. Promotes a healthy weight.

4. Reduces need for insulin.
5. Reduces need for oral hypoglycaemic drugs.
6. Promotes high HDL and low triglycerides.
7. Reduces hypoglycaemia.
8. Reduces development of glucose intolerance to Type 2 diabetes.
9. Optimizes glycaemic control including post prandial blood sugars.

For further information:

- Dr Richard Bernstein's website is www.diabetes-normalsugars.com His book Diabetes Solution, A Guide to Achieving Normal Blood Sugars is published by Little Brown & Co and the ISBN is 0316099066
- IDDT is frequently asked for information about carbohydrate values of foods and there is a comprehensive list on this website www.carbohydrate-counter.org
- Ron Raab - the low carbohydrate insulin regime: [www.diabetes-low-carb](http://www.diabetes-low-carb.com) or the University of Pittsburg site for a Power Point Presentation <http://www.pitt.edu/~super1/lecture/lec17721/index.htm>

IDDT's booklet 'Diabetes – Everyday Eating' provides you with help and advice about everyday eating and a four week menu plan. To obtain your FREE copy contact IDDT:

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