

S4. A case history

In this text-based activity pupils read a case history and carry out some literature research.

None of the answers can be found on the sheet; all have to be researched.

Answers to Pupil activity sheet S4:

1. Abnormal blood **glucose** levels, frequent in diabetes, can result in blurred vision. The technical term for the complications that can result from abnormal blood glucose is *diabetic retinopathy*. Retinopathy generally has no obvious symptoms until it is well advanced. It is important, therefore, for diabetics to have regular (annual) eye examinations.
2. In diabetes glucose levels in the blood rise. Eventually this glucose will reach a level where it cannot be reabsorbed back into the bloodstream in the kidney tubules. After this *threshold* level, glucose will begin to appear in the urine. Since glucose is removed from the body in solution, more water than normal will be lost from the body as the glucose is excreted. This tends to dehydrate the body with the response that the individual will feel thirsty.
3. *hyperglycaemia* - a higher blood glucose than normal. Symptoms include an increased thirst, increased frequency of passing urine, blurring of vision, nausea or vomiting, drowsiness, stomach pain, cold, dry skin, deep rapid breathing, sweet smell on the breath.

hypoglycaemia - a lower blood glucose level than normal. Symptoms include hunger, sweating, trembling, tingling of the lips, palpitations, blurring of vision, irritability.

4. If a diabetic were to have an accident whilst away from home or on their own, it is important for other people who are trying to care for them to know that they are diabetic. Being diabetic can have important consequences for the use of drugs, anaesthetics, etc.
5. It may happen that a diabetic will suffer from mild hypoglycaemia (have a mild 'hypo') if meals are slightly delayed or if extra exercise than expected was taken. By having sweets, etc. handy, it is possible to quickly reverse the symptoms.

*KS4 and above
science and technology*

Timing - various

This is an extension exercise; it could be a homework.

Two pupil activity sheets S4 accompany this activity.

The case study is a true account of a colleague's experiences.

Diabetic retinopathy affects the blood vessels supplying the retina (the light sensitive region of the eye). Blood vessels in this area may become blocked, leaky or grow haphazardly. This may eventually impair vision seriously and permanently.

By drinking orange juice, Ms G was actually adding more sugar into her bloodstream hence exacerbating the situation.

Continued overleaf.

6. Advice to diabetics:

When travelling by aeroplane carry all the diabetic equipment in hand luggage as suitcases have been known to go missing. Also the luggage hold is not heated and insulin stored at too low a temperature may freeze and be inactive. Always take spares of everything including insulin. This will cover breakages or delays in returning home. Some countries will not be able to supply the exact type of insulin used in this country.

Take extra food and snacks in hand luggage in case meals are missed.

In very hot climates special arrangements may have to be made to store insulin in a cool place.

Sugar free drinks may be difficult to get in some countries.

Meals should not really be a problem but it may be wise to check with a dietician before travelling.

Make sure that appropriate health insurance has been taken out.

On arrival make sure the whereabouts of the nearest doctor and hospital are known.

The effects of travelling through different time zones may have to be compensated for.

If the person suffers from travel sickness it may be appropriate to take travel sickness tablets; if sickness occurs then access to snacks to replace lost carbohydrate may be needed.

Insulin keeps best in a fridge.

7. Diabetes is not caused by a microorganism. There is no way that a diabetic can pass on the condition by any of the obvious methods of transmission. Like many conditions, it has been suggested that diabetes may run in families but it cannot be 'caught' from anyone.
8. The technique of *genetic engineering* has enabled the human insulin gene to be transferred to more simple organisms. These organisms are then able to produce large quantities of pure human insulin in a relatively short time.

(Some pupils may go into more detail about the procedures involved in genetic engineering.)

This is the story of a 39 year old woman who has been diagnosed as suffering from the more severe form of diabetes (early onset diabetes). It is quite unusual for someone to be diagnosed as having this more severe form of diabetes so late in life.

"I had been experiencing 'strange' vision for a few weeks. I had very poor long sight but my short sight did not seem to be affected. My vision often appeared 'misty'. I could recognise large shapes, like trees, but couldn't see detail, such as the leaves on the tree. I thought I ought to see an optician about getting some glasses. I made an appointment. As it turned out, I didn't get to that appointment.

I had other symptoms. I was very lethargic and felt very thirsty. I was drinking litres of orange juice at a time to try and quench my thirst. It was on a Thursday of one particular week that I began to feel really ill. I tried to make an appointment with the doctor but could not get one until the following Tuesday.

The following day I could not even go to work. By the time Saturday arrived I was so desperate that I rang the doctor for an emergency appointment and went down to the surgery. Whilst sitting in the waiting room I remember feeling almost 'drunk' and 'completely out of it'.

On hearing my symptoms, the doctor immediately suggested that I may be developing diabetes. I gave the doctor a sample of urine so that it could be tested for the presence of glucose. This test proved positive. The doctor then took a drop of blood from my finger to measure the amount of glucose in it. The normal level of glucose is between 4 - 7 mmol/dm³. Mine was 26mmol/dm³!! The doctor told me that this was a very good indication that I had a serious problem. He sent me immediately to hospital. I remained remarkably calm given the circumstances. I think I was just too ill to have any other sort of reaction!

I arrived at the hospital at about 10.30am. I was weighed and had my height measured. They carried out two more tests. One tested for the presence of substances called ketones in the urine. These substances appear when the amount of insulin in the blood is low. This result was positive but it was not a major cause for concern at that stage. The other test is called the glycosylated haemoglobin test. This test is able to indicate the average glucose level in the blood for the previous few months. This resulted in a higher figure than normal. There was no doubt about it; I was definitely developing diabetes.

These tests had taken quite a long time to perform. It was not until 2.30pm that the hospital decided they had enough information about me to enable them to estimate a correct amount of insulin to inject me with at that moment. They then taught me how to inject myself and how to measure my blood glucose levels. By 4.00pm that afternoon I was in a healthy enough state to be sent home.

I returned the following morning and two days later for more help and information.

A few days after my diagnosis, it hit me. I would be measuring my blood glucose levels and injecting insulin for the rest of my life. It seemed such a shock but now it is just part of my normal routine. It's not nice but it's manageable.

Ms G has at least two very good factors in her favour. Firstly, she is not at all overweight. Secondly, she was already eating a suitable diet. The only changes she has had to make is that she avoids sweet, sugary foods like chocolate, cakes and puddings. She drinks low calorie (low kcal/kJ) or 'diet' versions of drinks. The only specialist diabetic product she has purchased is low sugar jam.

For Ms G the greatest inconvenience is not the twice daily measuring of blood glucose levels. It isn't even the twice daily insulin injections. It is how nothing 'unexpected' can be allowed to happen with respect to food. There can be no skipped or missed meals; no surprise bars of chocolate; no unexpected delays at meal times, for example, in restaurants. It has also been surprising to find out that some people think they will be able 'catch' diabetes from her!

Diabetics can and do lead full and active lives. More often than not their condition and their self discipline remain entirely unnoticed by the rest of us.

You will have to do some research to answer the following questions.

1. At the beginning, Ms G described how her vision was being affected. Diabetics are allowed to have free and regular eye examinations. Find out why there is concern for a diabetic's eyes.
2. Ms G felt very thirsty and drank large amounts of orange juice. Why does diabetes make someone so thirsty? Why was drinking orange juice actually a mistake?
3. Diabetics can suffer hyperglycaemia and hypoglycaemia. What do these words mean? What symptoms are associated with these situations?
4. Diabetics are advised to wear some form of identification, such as a necklace or bracelet, explaining that they have insulin dependent diabetes. Why is this a sensible precaution?
5. Diabetics are advised to always carry with them some sugar or sweets. Why is this a sensible precaution?
6. What special considerations should a diabetic take when planning a holiday abroad?
7. How would you explain to someone that you cannot 'catch' diabetes from a diabetic?
8. Insulin was originally obtained by extracting it from the pancreas of cows. This led to objections from diabetics who were vegetarian. Also cow insulin is not the same as human insulin. Find out how modern technology has been able to produce sufficient quantities of 'human' insulin.