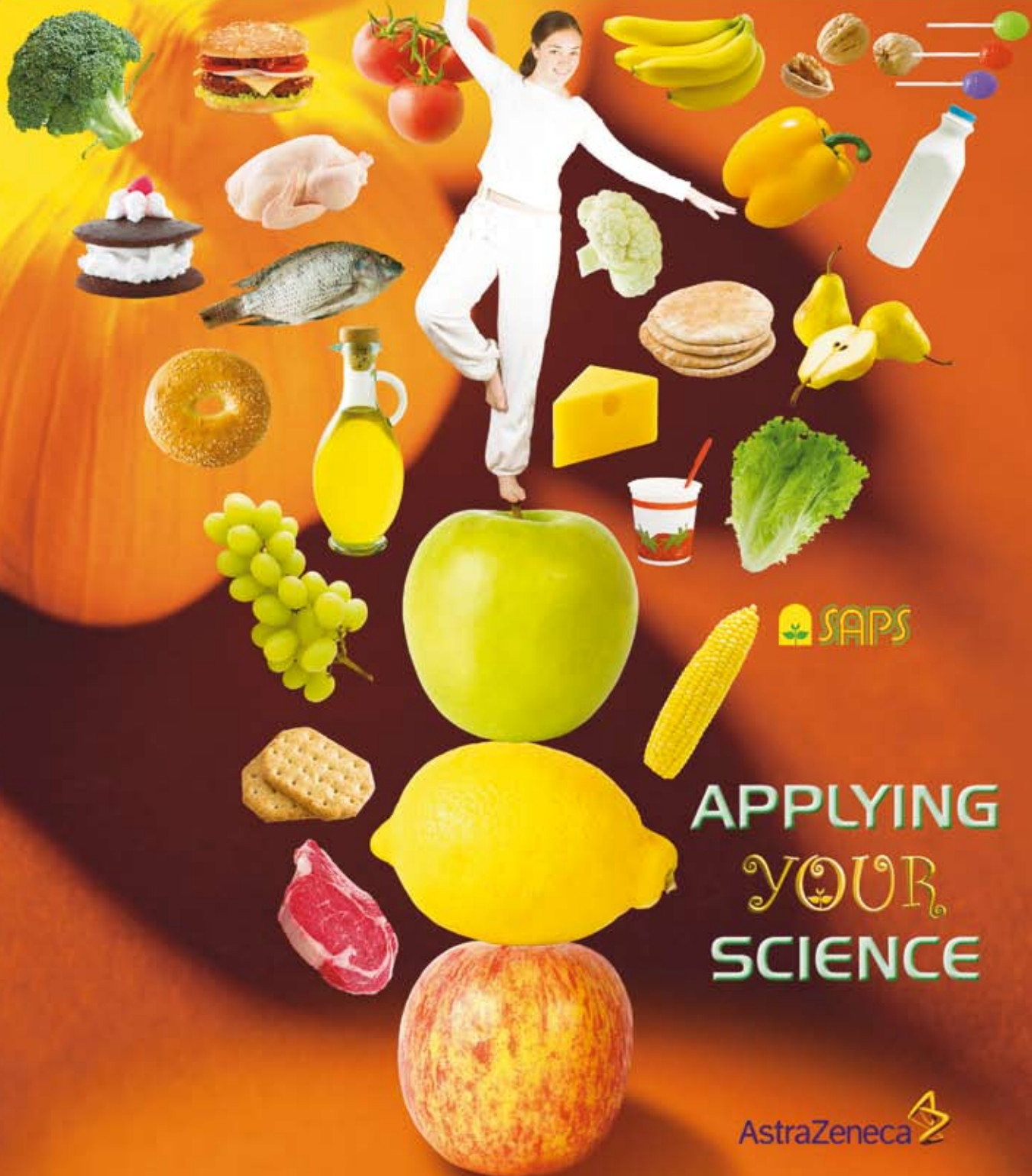


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 SAPS

APPLYING
YOUR
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Obesity



- People are often said to be obese if they have a weight to height ratio or BMI (body mass index) over 30
- Around 24 million adults in the UK are overweight or obese¹
- In the past 10 years obesity has doubled in six year olds and trebled amongst 15 year olds²
- Almost 20% of Scottish 12 year olds are obese³
- Overweight adolescents have a 70% chance of becoming overweight or obese adults⁴
- Obesity may be caused by inappropriate diet, sedentary life style and genetic factors
- Chronic health problems linked to obesity include: heart disease, high blood pressure, osteoarthritis and Type 2 diabetes

Type 2 Diabetes



- By 2010, 221 million people worldwide will have diabetes⁵
- Type 2 diabetes reduces life expectancy on average by up to 10 years⁶
- The vast majority of people with Type 2 diabetes are overweight or obese⁷
- Type 2 diabetes is usually diagnosed when the body can no longer effectively use insulin to transfer glucose to cells and tissues
- Type 2 diabetes is now being seen in obese schoolchildren – previously it was only seen in adults⁸
- Type 2 diabetes is a progressive disease of both glucose and lipid metabolism
- Controlling blood glucose levels is only one part of the problem for patients with diabetes – it is a complex metabolic disorder requiring early diagnosis and a variety of treatments and changes in lifestyle

Diet, Diabetes and Obesity & Lifestyle



- Type 2 diabetes is inextricably linked with diet and obesity
- Children in Britain eat on average only 2 portions of fruit and vegetables per day⁹
- 4–18 year olds eat higher than recommended amounts of saturated fat and sugar¹⁰
- Portion sizes are increasing, particularly of 'energy dense' snack and fast foods¹¹
- Schoolchildren spend £549 million a year on snacks on the way to and from school in the UK¹²
- Around 50% of children have less than the one hour recommended physical activity per day¹³



DRUG TREATMENTS

OBESITY – diet is the primary means of treatment. For 'morbid' obesity, some drugs are available which work mainly by suppressing the appetite.

DIABETES – is treated in a variety of ways e.g. insulin is often given by injection to help to control blood sugar level. A class of drugs called statins are given to diabetic patients to reduce their cholesterol (LDL) and triglycerides. PPAR agonists are new molecules which may improve glucose metabolism and improve lipid profile¹⁴.

More detailed information can be found at:

http://www.abpi.org.uk/publications/publication_details/targetDiabetes2/dandp1.asp

PREDICTIONS AND RISKS

By 2010 it is predicted that one in four adults will be obese costing an estimated £3.6 billion to the NHS and the economy¹⁵. It is predicted that by 2011, 10% of the NHS budget will go on treating diabetes¹⁶. Obesity is associated with more chronic health problems than is smoking¹⁷.

R I S K F A C T O R S

O

R T Y P E 2 D I A B E T E S

Allocate one risk factor per group of students. Each group should (a) discuss and determine the issues associated with each risk factor, (b) check out the information boxes and suggested web sites for each, and (c) feedback their findings to the rest of the class in a creative style.

DIET

GI-glycemic index and Glycemic loading:
High fat diet suppresses a key enzyme that triggers beta cells in pancreas to produce insulin.

<http://www.hhmi.org/news/marth20051229.html>

GENETICS

How many people in your family have been diagnosed with diabetes?

<http://www.diabetes.org.uk/Guide-to-diabetes/>

http://genome.wellcome.ac.uk/doc_wtd020843.html

FOETAL HISTORY

Is there a history of gestational diabetes in your family? Any babies born over 4 kg? Any babies of very low birth weight?

<http://www.diabetes.org.uk/Guide-to-diabetes/>

BODY SHAPE

Apple or pear? Calculate your BMI. Or is waist size a better measurement?

<http://www.diabetes.org.uk/Guide-to-diabetes/>

<http://www.medicalnewstoday.com/medicalnews.php?newsid=21444>

IMPAIRED GLUCOSE TOLERANCE: PRE-DIABETES

Effects of blood glucose being higher than normal.

<http://www.diabetes.org.uk/Guide-to-diabetes/>

INSULIN RESISTANCE

Blood glucose and insulin levels can be high at the same time. Muscle, fat liver cells do not use insulin properly.

Metabolic Syndrome

<http://diabetes.niddk.nih.gov/dm/pubs/insulinresistance/>

AGE

Type 2 diabetes is mainly found in over 40s but is increasingly being diagnosed in younger age groups.

http://www.channel4.com/health/microsites/09/4health/body/ill_diabetes.html

HIGH BLOOD PRESSURE

(Hypertension) Treating hypertension reduces the risk of developing diabetes.

<http://www.endocrine-abstracts.org/ea/0006/ea006ds3.htm>

INACTIVITY

Brisk walking of at least 30 minutes for five days a week can lower the risk of developing diabetes.

<http://www.hsph.harvard.edu/ats/Oct22/>

WHICH GROUPS ARE MOST AT RISK?

African-Caribbean, South Asian people.

<http://www.diabetes.org.uk/Guide-to-diabetes/>

HIGH CHOLESTEROL

Increased LDL, decreased HDL, increased triglycerides, increased blood pressure.

<http://www.diabetes.org/type-1-diabetes/well-being/treating-cholesterol.jsp>

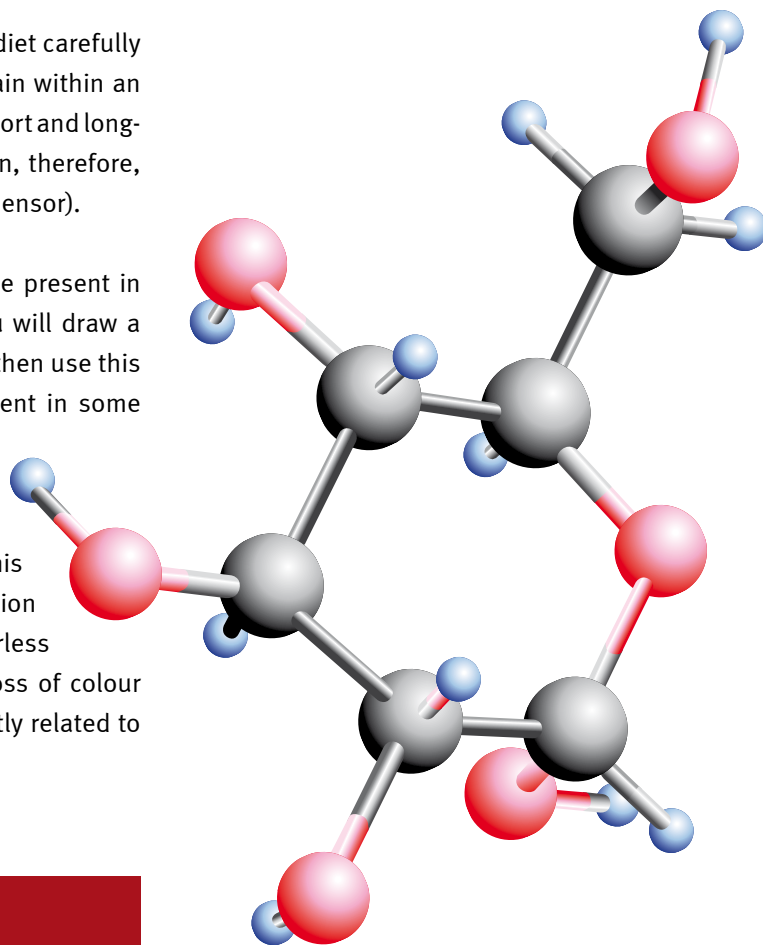
Teacher's Guide gives more general web links.

PRACTICAL ACTIVITY: ESTIMATING GLUCOSE CONCENTRATION IN SOLUTION

People with diabetes have to monitor and control their diet carefully to ensure that their blood glucose concentrations remain within an acceptable range, as levels outside this range result in short and long-term health problems. The blood glucose concentration, therefore, has to be checked regularly, usually using a meter (biosensor).

In this practical you will test the percentage of glucose present in a variety of solutions of known concentration and you will draw a graph (a standard curve) to show your results. You will then use this graph to estimate the concentrations of glucose present in some unknown solutions.

Glucose ($C_6H_{12}O_6$) is a monosaccharide reducing sugar (i.e. it donates electrons under acidic conditions). In this reaction the electrons are accepted by a pink solution of potassium permanganate reducing it to a colourless solution of manganese ions. The time taken for the loss of colour from a standardised solution of permanganate is directly related to the concentration of glucose present in solution.



INSTRUCTIONS

- 1 Label your syringes (G for Glucose, P for Potassium permanganate and S for Sulfuric acid).
- 2 Label the boiling tubes with the different glucose concentrations.
- 3 Use the correct syringe to place 10 cm³ of the 2% glucose solution into the boiling tube marked '2%'.
- 4 Add 5 cm³ of sulfuric acid.
- 5 Add 2 cm³ of potassium permanganate and start the timer.
- 6 Stir with a stirring rod and stop the timer as soon as the pink colour disappears.
- 7 Record the time taken (in seconds) and the concentration of glucose solution used.
- 8 Repeat using the other glucose solutions of known concentration, working from the least to most concentrated solution in order.
- 9 Using fresh boiling tubes repeat steps 4–7 for each of the glucose solutions of unknown concentration (A, B and C).
- 10 Record your own results and, if possible, class average results in a table.
- 11 Plot a standard curve of the class results on graph paper and use this to estimate by interpolation the concentrations of the three unknown solutions. Show your interpolation on the graph.
- 12 Now plot a graph showing the rate of reaction (i.e. $1/t$ against concentration of glucose) using class average results.

Equipment And Materials Required By Each Group

Safety spectacles

Labels/marker pens

Timer

Glucose solutions
(2%, 4%, 6%, 8% and 10%)

Glass rod

3 solutions of unknown glucose
concentration marked A, B and C

Boiling tubes

Boiling tube rack

Sulfuric acid

3 syringes

Potassium permanganate

EVALUATING YOUR EXPERIMENT

In your evaluation of the experiment you should discuss:

The effectiveness of the procedure (e.g. compare class average results with your group's results, and with the actual concentrations of the unknown solutions which your teacher will tell you)

The limitations of the equipment

Sources of error

Possible improvements in your method

Ideas for further work

The importance of the procedure

CONCLUSIONS

Describe any trend you see in your graphs

Relate your results back to the aim of the experiment

Estimate the concentrations of the unknown solutions

People with Type 1 diabetes have to test their blood sugar levels much more frequently than those with Type 2 diabetes. In small groups discuss the possible reason(s) for this difference.

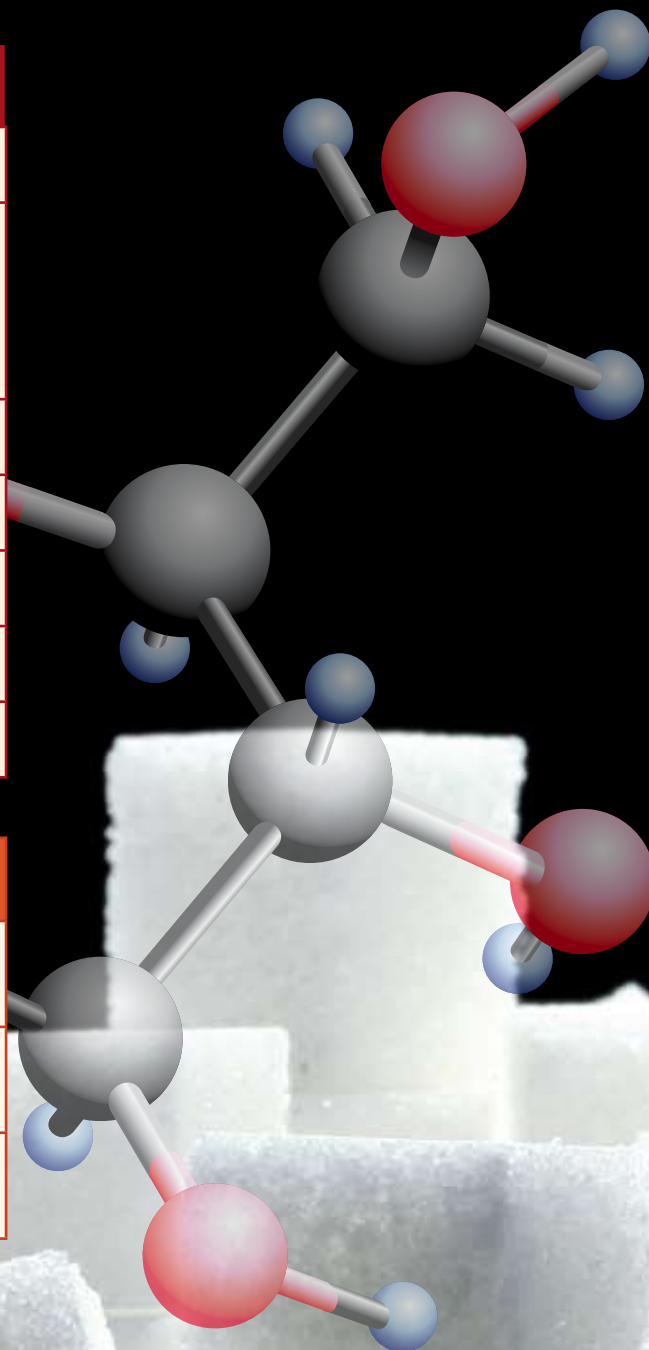
Summarise your explanation in writing for presentation to the rest of the class.

Discuss what you have learned about diabetes and its prevalence and write down three points about diabetes which you think people of your age should be aware of.

References:

<http://www.saps.plantsci.cam.ac.uk/worksheets/scotland/glucose.htm>

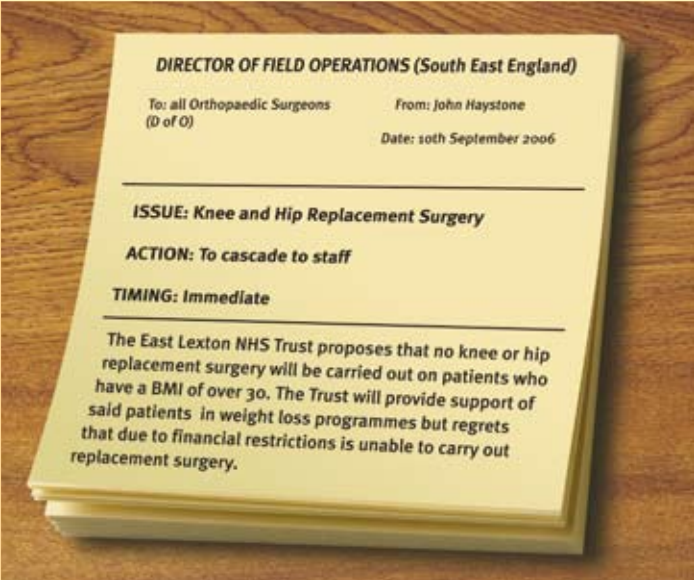
Freeland, P.W. (1985). Problems in Practical Advanced Level Biology. Hodder and Stoughton, London.



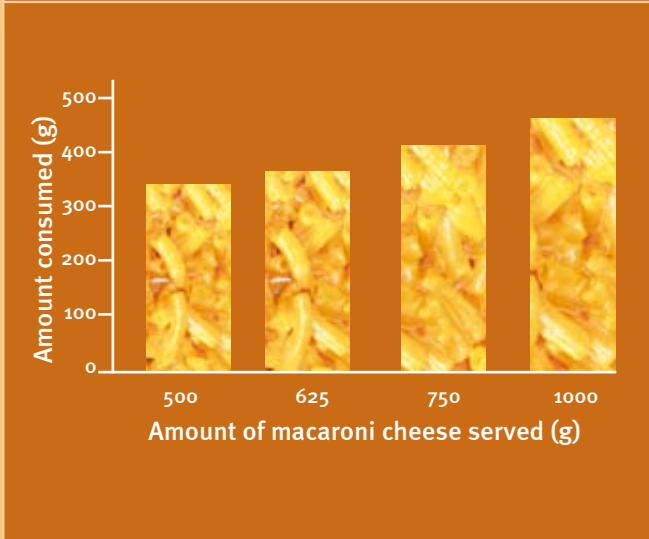
TYPE 2 D I A B E T E S D E B A T E I H O B E S I T Y I S S U E S T

Pick a box. Think about what it shows. Is this a problem? Do you have any concerns? Can society make a difference? Who should be involved? How does it make you feel?

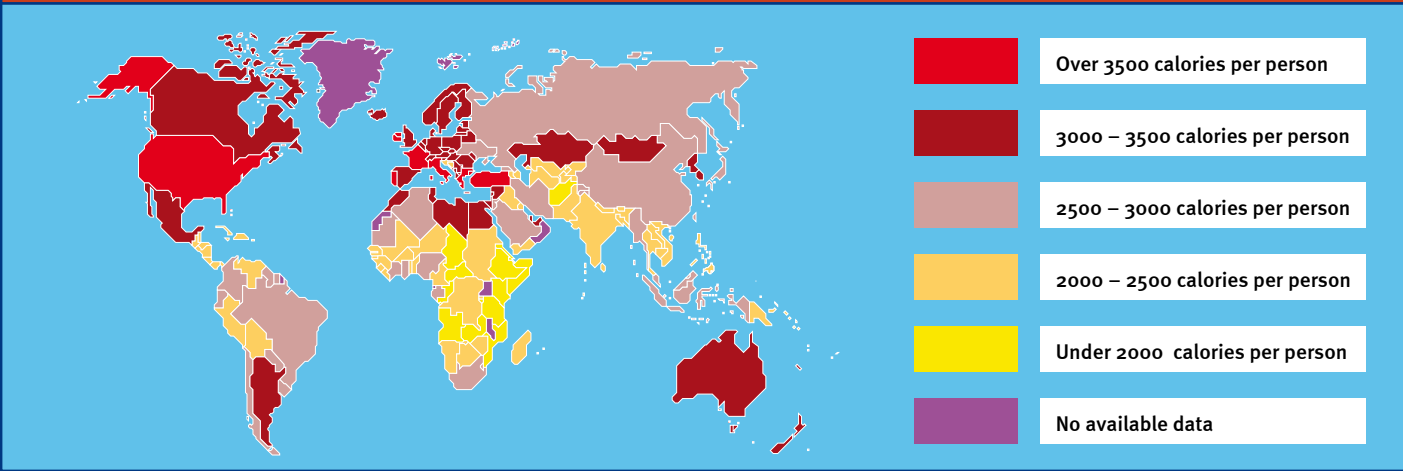
Although this is a fictional memo, it should be noted that there are NHS Trusts that have suggested this strategy.



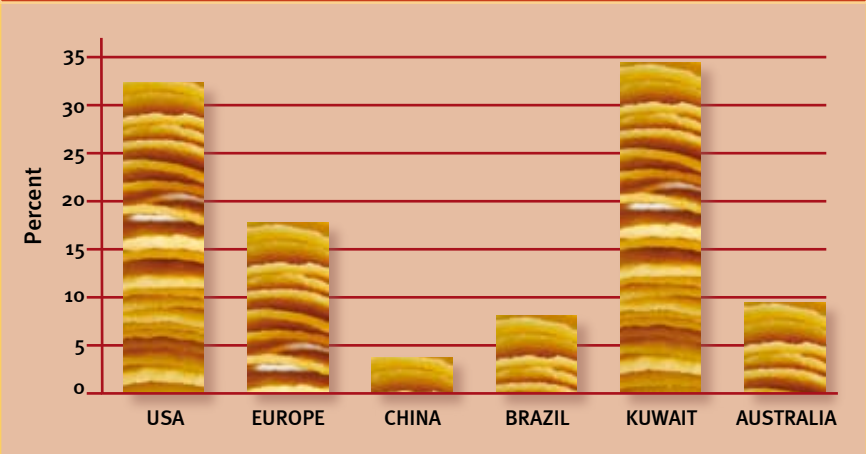
Food portion size affects energy intake. In this study, young adult men and women were served four different portions of macaroni cheese for lunch on different days, and were allowed to consume as much of the portion as they liked¹⁸



Daily food consumption of the World (1997) (Adapted from¹⁹)



Prevalence of obesity in some areas (Adapted from²⁰)



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- 19 FAO: www.fao.org/News/1998/981204-e.htm
- 20 Hoffman DJ for FAO: http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/003/Y0600M/y0600m05.htm





Curriculum Links	
<p>SCOTLAND Advanced Higher Biology</p>	<p>Cell and Molecular Biology: Structure and function of cell components. Carbohydrates, lipids, cell signalling.</p> <p>Physiology, Health and Exercise: b) Exercise and metabolism. Link between diet and obesity; Effects of exercise on weight control; Control of blood glucose levels; Non-insulin dependent diabetes; Diabetes and obesity; Effect of exercise on diabetes.</p>
<p>ENGLAND and WALES A/AS Level Biology</p>	<p>Edexcel 4.2 Regulation of the internal environment. Action of insulin and glucagon in the regulation of the blood glucose level. C.2 Exercise physiology. Exercise and the cardiovascular system. C.3 Human disorders – coronary heart disease.</p> <p>AQA A2 module 6 Physiology and the environment. Control of blood glucose concentration – role of insulin and glucagon. Diabetes and its control with insulin and by manipulation of carbohydrate intake.</p> <p>Salter-Nuffield Advanced Biology AS Topic 1 Lifestyle, health and risk. The role of diet and other lifestyle factors in maintaining good health.</p>
<p>NORTHERN IRELAND</p>	<p>CCEA – AS and A Level GCE Biology Module 1 – Molecules – carbohydrates. Module 4 – Homeostasis – the principles of endocrine control.</p>

Materials for the practical activity

10 cm³ of each glucose solution (2%, 4%, 6%, 8%, and 10%).

3 solutions of unknown glucose concentration (A – 8% glucose, B – water, C – 5% glucose);
(Any number of solutions of unknown concentration could be provided).

50 cm³ 1 M sulfuric acid (mol dm⁻³).

20 cm³ potassium permanganate (0.4 g dm⁻³).
(N.B. potassium permanganate must be made up just before use).

It is advisable to have slightly more of each solution available as some groups may need to repeat parts of the experiment.

Links to related resources

OBESITY: THE BIG PICTURE <http://www.wellcome.ac.uk/node5951.html>

<http://www.food.gov.uk/healthiereating/advertisingtochildren/promotion/promofacts/>

<http://www.bbc.co.uk/science/hottopics/obesity/index.shtml>

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