HIGHER HUMAN BIOLOGY: Assignment

Resource Pack: The Global Rise in Obesity and Type 2 Diabetes

In this assessment learners have to investigate a relevant topic in biology and communicate their research findings in a report. The suggested topic relates to a key area of the Higher Human Biology Course.

The assignment assesses the following skills, knowledge and understanding:

- applying knowledge of biology to new situations and analysing information
- selecting information from a variety of sources
- presenting information appropriately in a variety of forms
- processing the information/data collected (using calculations and units, where appropriate)
- drawing valid conclusions and giving explanations supported by evidence/justification
- evaluating experimental/practical investigations
- communicating findings/information effectively

UNIT – PHYSIOLOGY and HEALTH

Area of the curriculum

8 Blood glucose levels and obesity
(a) Chronic elevated blood glucose levels leads to atherosclerosis and blood vessel damage. Pancreatic receptors and the role of hormones in negative feedback control of blood glucose through insulin, glucagon and adrenaline (epinephrine).

Diagnosis, treatments and role of insulin in type 1 and type 2 diabetes.

(b) Obesity linked to cardiovascular disease and diabetes.

This resource pack provides information on:
1. Type 1 and Type 2 diabetes
2. Obesity
3. Global increases in obesity
4. Global increases in diabetes
5. Risk factors in diabetes
6. Global actions to reduce type 2 diabetes
7. Glossary
Background Information

Diabetes

Diabetes mellitus is a condition in which the amount of glucose (sugar) in the blood is too high because the body cannot use it properly. There are 2 main types of diabetes:

- **Type 1 diabetes** - develops if the body cannot produce insulin, the hormone needed to enable glucose to enter the body’s cells.
- **Type 2 diabetes** - develops when the body can still make some insulin but not enough, or when the insulin produced does not work properly.

Type 1 Diabetes

Type 1 diabetes occurs when the body’s own immune system destroys the insulin-producing cells of the pancreas (called beta cells) but for unknown reasons, in people with type 1 diabetes, the immune system attacks various cells in the body. This results in a complete deficiency of the insulin hormone. Symptoms of type 1 diabetes usually develop quickly, over a few days to weeks, and are caused by blood sugar levels rising above the normal range (hyperglycemia). You can inherit a tendency to develop type 1 diabetes, but most people who have the disease have no family history of it. Type 1 diabetes requires lifelong treatment to keep blood sugar levels within a normal range.

Type 2 Diabetes

Unlike people with type 1 diabetes, the bodies of people with type 2 diabetes make insulin, but either their pancreas does not make enough insulin or the body cannot use the insulin well enough. Such a situation is called insulin resistance. When there isn't enough insulin or the insulin is not used as it should be, glucose cannot pass into the body’s cells. When glucose builds up in the blood instead of passing into cells, the body's cells are not able to function properly. Over time, the high glucose levels in the blood can damage the nerves and small blood vessels of the eyes, kidneys, and heart and lead to atherosclerosis, or hardening of the arteries that can cause heart attack and stroke. People are at risk of developing Type 2 diabetes if they are overweight, have a close family member with the condition, or are of Afro-Caribbean or South Asian ethnicity. Until recently Type 2 diabetes was only recognised in older people; however, now more children are being diagnosed with the condition.

Obesity

People are said to be obese if they have a BMI (body mass index) over 30. BMI is defined as a person's weight in kilograms divided by the square of his/her height in meters (kg/m²).

See [http://www.nhs.uk/Tools/Pages/Healthyweightcalculator.aspx](http://www.nhs.uk/Tools/Pages/Healthyweightcalculator.aspx)

In the UK around 25% of adults are obese - the figure is highest in Scotland where it is predicted that by 2030 obesity rates could reach 40%. Around 30% of children in the UK are overweight or obese. Obesity may be caused by inappropriate diet, sedentary lifestyle, and/or genetic factors. Chronic health problems linked to obesity include; heart disease, high blood pressure, osteoarthritis and Type 2 diabetes.
GLOBAL FINDINGS

Global increases in Obesity

At one time obesity was seen as just a problem of wealthy nations, but now it impacts upon countries at all economic levels.

A World Health Organisation (WHO) reports show that:

- Worldwide the rate of obesity has nearly doubled since 1980, with just over 200 million adult men and just under 300 million adult women obese.
- Obesity rates have been steadily rising in children, too: In 2010, 43 million preschool children were overweight or obese, a 60 percent increase since 1990.
- These jumps in child and adult obesity rates show no sign of stopping without dedicated efforts to combat the epidemic.

More details can be found at: http://www.who.int/mediacentre/factsheets/fs311/en/


This study was led by Professor Emmanuela Gakidou from the Institute for Health Metrics and Evaluation at the University of Washington in the USA and a team of international researchers. The authors warn that the study presents a worrying picture of substantial rises in obesity rates across the world and say that concerted action is urgently needed to reverse this trend. According to Professor Gakidou, "Unlike other major global health risks, such as tobacco and childhood nutrition, obesity is not decreasing worldwide. Our findings show that increases in the prevalence of obesity have been substantial, widespread, and have arisen over a short time." The data also gives estimates of the numbers of deaths and the years of life lost which are attributed to this obesity crisis.
A summary of the findings:

Worldwide, the proportion of adults with a body-mass index (BMI) of 25 kg/m² or greater increased between 1980 and 2013 from 28·8% to 36·9% in men, and from 29·8% to 38·0% in women. Prevalence has increased substantially in children and adolescents in developed countries; 23·8% of boys and 22·6% of girls were overweight or obese in 2013. The prevalence of overweight and obesity has also increased in children and adolescents in developing countries, from 12·1% to 12·9% in 2013 for boys and from 8·4% to 13·4% in girls. In adults, estimated prevalence of obesity exceeded 50% in men in Tonga and in women in Kuwait, Kiribati, Federated States of Micronesia, Libya, Qatar, Tonga, and Samoa. Since 2006, the increase in adult obesity in developed countries has slowed down.

Global increases in Diabetes

Around 400 million people worldwide have diabetes and it is predicted to become the seventh leading cause of death in the world by the year 2030. In Britain it is estimated that by 2035 nearly 20% of the NHS budget will go on treating the disease - this is some £500 per second. 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 to avoid serious health problems.

The global growth in type 2 diabetes parallels the global rise in obesity and it is often referred to as an epidemic. Asia’s huge population, its very rapid economic growth and the move away from the traditional way of life has, in some ways, made it the epicentre of the epidemic. In countries such as China the following trends can be seen:

![Graph of time trends of diabetes prevalence in Chinese adults.](http://care.diabetesjournals.org/content/34/6/1249.full)

Detailed data about the many factors which contribute to the, so called, Asian Diabetes epidemic can be found in the study: Globalization of Diabetes; The role of diet, lifestyle, and genes; Frank B. Hu, MD, PHD and the study can be accessed at: http://care.diabetesjournals.org/content/34/6/1249.full
In the above paper a number of factors and their relationship with type 2 diabetes are explored:

- Obesity and fat distribution
- The role of diet
- Physical activity
- The role of smoking and alcohol, and
- Genetic susceptibility

The International Diabetes Federation (IDL) [http://www.idf.org/diabetesatlas/introduction](http://www.idf.org/diabetesatlas/introduction) summarises regional data about diabetes:

- In **Africa**, 76% of deaths due to diabetes are in people under the age of 60
- **Europe** has the highest prevalence of type 1 diabetes in children
- In the **Middle East and North Africa**, 1 in 10 adults has diabetes
- More was spent on healthcare for diabetes in **North America and the Caribbean** than in any other region
- In **South and Central America**, the number of people with diabetes will increase by 60% by 2035
- In **South-East Asia**, almost half of people with diabetes are undiagnosed
- In the **Western Pacific**, 138 million adults have diabetes – the largest number of any region.

IDL also produces graphical interpretations of the global type 2 diabetes picture:

- [http://www.idf.org/atlasmap/atlasmap](http://www.idf.org/atlasmap)
RISK FACTORS IN DIABETES

The risk factors for **type 1 diabetes** are still being researched. However, having a family member with type 1 diabetes slightly increases the risk of developing the disease. Environmental factors and exposure to some viral infections have also been linked to the risk of developing type 1 diabetes.

Risk factors which have been associated with **type 2 diabetes** and include:

- Family history of diabetes
- Overweight
- Unhealthy diet
- Physical inactivity
- Increasing age
- High blood pressure
- Ethnicity
- Impaired glucose tolerance
- History of gestational diabetes
- Poor nutrition during pregnancy

**Impaired glucose tolerance (IGT)** is a category of higher than normal blood glucose, but below the threshold for diagnosing diabetes. Changes in diet and physical activity related to rapid development and urbanisation have led to sharp increases in the numbers of people developing diabetes. Pregnant women who are overweight, have been diagnosed with IGT, or have a family history of diabetes are all at increased risk of developing **gestational diabetes mellitus (GDM)**. In addition, having been previously diagnosed with gestational diabetes or being of certain ethnic groups puts women at increased risk of developing GDM.
GLOBAL ACTIONS TO REDUCE TYPE 2 DIABETES

Governments throughout the world are clearly very concerned about the massive increases in obesity and type 2 diabetes. The International Diabetes Federation has produced a Global Diabetes Plan 2011-2021.


The Global Diabetes Plan calls on the United Nations and its agencies, governments, civil society, the private sector and the global diabetes community to turn the tide of diabetes now.

The purpose of the Global Diabetes Plan is to:

1. Reframe the debate on diabetes to further raise political awareness of its causes and consequences and the urgent need for action at the global and country level to prevent and treat diabetes
2. Set out a generic, globally consistent plan to support and guide the efforts of governments, international donors and IDF member associations to combat diabetes
3. Propose proven interventions, processes and partnership for reducing the personal and societal burden of diabetes
4. Support and build on existing policies and initiatives such as the WHO 2008-2013 Action Plan for the Global Strategy for the Prevention and Control of Non-communicable Diseases.
5. Strengthen the global movement to combat the diabetes epidemic and to improve the health and lives of people with diabetes.

The Scottish Government has a Diabetes Action Plan 2010 which can be found at:
http://www.scotland.gov.uk/Publications/2010/08/17095311/4
• BMI (body mass index) - your weight in kg divided by (your height in (metres)^2). A healthy BMI is between 18.5 and 24.9; between 25 and 29.9 is overweight; greater than 30 is obese.
• Insulin - The hormone that helps the cells of the body to use glucose. It is produced by cells in the pancreas. Insulin cannot be replaced by mouth as it is destroyed by the stomach juices; people with Type 1 diabetes, and those with Type 2 diabetes that cannot be helped by tablets have 2-4 injections a day.
• Pancreas - A gland near the stomach that produces insulin.
• Risk factor - A characteristic that increases your chance of getting a particular disease.
• Saturated fat - Fat that occurs in living matter such as animals and plants is used as food, and contains different amounts of saturated and unsaturated fats (the difference being in their chemical structure). Saturated fats occur in dairy products (cream, cheese, butter), chocolate, meat, and many processed meals. A diet high in saturated fat increases the chances of suffering heart disease and stroke.

General information about diabetes can be found at:

http://www.diabetes.co.uk/nhs/

http://www.diabetes.org.uk/