SEVILLA INTERNATIONAL COLLEGE
SAN FRANCISCO DE PAULA
SCIENCES DEPARTMENT

Unit 2. Nutrition: Diet and Health

Key words

Heterotrophic	monosaccharide	polysaccharide	fatty acids	diabetes
Obesity	molecules	carbohydrates	glycerol	cholesterol
Malnutrition	haemoglobin	absorption	anorexia	bulimia

What does our body need to function properly?

Nutrition supplies living organisms with the molecules that they need to keep them alive.

As we have heterotrophic nutrition, we are constantly taking in **organic** and **inorganic** molecules from our surrounding environment that our systems transform in order to obtain the needed energy to drive life processes and the raw material for the growth and repair of tissues. These organic and inorganic molecules that our cells need are referred to as **nutrients**.

Feeding is the process by which those nutrients are obtained from the environment, while **nutrition** includes a number of processes that allow organisms to transform those nutrients so our cells can use them.

Our health depends on our diet, or the kind of food that we eat. Not including the necessary nutrients and in the correct proportion, may result in malnutrition, which could lead to malfunctioning of the body and often times to illness.

If you recall from the previous unit, a poor diet can lead to some non-infectious diseases such as endocrine and metabolic diseases or deficiency diseases. We will focus on obesity and diabetes as examples of endocrine and metabolic diseases, and look into anaemia as a deficiency disease. However, there are many other diseases directly related to a poor diet so it is very important that you understand what a balanced diet is and how to develop healthy eating habits.
Activity: What is obesity? How can you avoid obesity? How does it affect your body/systems? Give at least three examples of other diseases that are/can be directly caused by obesity.
What is diabetes? There are three types of diabetes, type 1, type 2 and gestational diabetes. Which type is it more common and due to a poor diet, high in sugars?

A **balanced diet** provides all the nutrients in the correct amounts needed to carry out the life processes. The **Mediterranean diet** is a very good example of a balanced diet, as we will see in more detail.

There are also psychological diseases that are not directly related to a poor diet but would lead to eating disorders and therefore later complications such as anorexia and bulimia.

Types of Nutrients

If we look at the chemical composition of nutrients, we can differentiate between organic and inorganic nutrients. Carbohydrates, lipids and proteins, are organic nutrients, and vitamins, water and minerals are inorganic nutrients.

The majority of foods have several types of nutrients, but some such as white sugar or table salt only have one. Let's look at the different nutrients in more detail.

Carbohydrates: there are two types: monosaccharides and polysaccharides. Their main function is to provide our cells with energy.

.

***Monosaccharides** are the simplest carbohydrates, for example glucose, and fructose, found in honey and fruits. They are soluble in water, so they are easily transported in blood and dissolve in the cytoplasm of the cell. Glucose is oxidised (used) in cellular respiration to release energy for different processes such as active transport, cell division, muscle contraction etc. It is therefore the main source of energy for our cells.

***Polysaccharides:** Complex molecules formed by joining several monosaccharides together. They must be split into simple monosaccharides in order to be used by our cells. They are water insoluble so they are good stores of energy. The most important one involved in human nutrition is starch, which is made by joining many thousands of glucose molecules together. Cellulose, contained in vegetable fibre, also belongs to this group, and even though we cannot use it as a source of energy plays an important role in our diets, as we will see later.

Excess carbohydrates can be stored as glycogen and fats

Lipids: Lipids, also known as fats are an important source of energy. They are particularly valuable as **energy storage** because they are insoluble in water. They are stored in the cells of adipose tissue. Lipids are formed by joining three molecules of **fatty acids** to one molecule of **glycerol**. There are two types of lipids: fats, which are solid at room temperature and oils, which are liquid at room temperature. Lipids are a main component of cell membranes, forming barriers between watery environments, such as the cell and its surrounding. They also provide insulation (electrical insulation around nerve cells, and thermal insulation beneath the skin). Steroids hormones, including sex hormones are made from cholesterol. The most familiar/known lipids are triglycerides and cholesterol.

Proteins: These nutrients are the most important macromolecules. Around 50% of the dry cell mass in our body are proteins. Proteins carry out many different functions such as: *structural materials - muscles, tendons, bones, nails and hair - *transport molecules, such as haemoglobin in blood, *hormones, such as insulin, *natural catalyst, as all enzymes are proteins, *in defence

against diseases (antibodies). **(enzymes regulate all the metabolic reactions in our body)** Proteins are made of long chains of subunits called **amino acids** joined together. There are 20 different amino acids. All proteins are made from the same 20 amino acids that are joined in a vast number of different orders. Out of these 20 amino acids, 12 can be produced by our body, however, there are 8 amino acids we cannot produce and must be provided by our diet. We refer to those as the **essential amino acids**. Amino acids are soluble so they are easily transported in living organisms.

Vitamins and mineral: Substances essential for the body as they regulate metabolic reactions as well as allow our bodies to use other nutrients efficiently. Some minerals make up the structure of our body, for example calcium is an important constituent in bones and teeth. Some other minerals are used to regulate the nervous system, such as sodium and potassium. And Iron takes part in oxygen transport. Vitamin D is needed for the absorption of calcium. And vitamin C aids with the absorption of iron.
Vitamins and mineral are only needed in very small amounts, but lacking the necessary vitamins can cause a variety of problems and illnesses.

Water: It is essential for life as we know it. Water forms about 70% of the human body. (2/3 of this water is in the cytoplasm of cells, and the other 1/3 in tissue fluid and blood plasma). Water acts as a solvent in metabolic reaction, transport media for substances between different parts of the body and regulates body temperature.
We lose water every day in urine, faeces, exhaled air and sweat that must be replaced by water in the diet.

Energy value of different foods

Food is the fuel that drives life processes as energy is released from the different foods we eat during cellular respiration. The three main energy-providing organic molecules found in food are fats, carbohydrates and proteins, each having a different value.

Molecules	Energy content (kJ/g)	Energy content (cal/g)
Fats	39	
Carbohydrates	20	
Proteins	17	

If you recall from previous years, a joule (J) is the SI unit of energy. The amount of energy contained in food is measured in either joules (J) or calories (cal). However, when talking about

food, most people talk about calories. But, what is a calorie? A calorie is the amount of energy needed to raise the temperature of 1 cm^3 (1 mL) of water 1 ºC.
In food labels, as joules and calories are small units, kilojoules and kilocalories are more frequently used to describe the energy values of food.

1calorie = 4.2 joules

Calculate the number of calories per gram for each of the main energy-providing organic molecules and include it in the table above.

Remember that not everyone needs the same amount of calories per day, as our energy requirements will be different according to our age, gender and life style, among others.

Food and the Ideal Diet

Classification of different food types.

Food type	Example	Nutrients
Milk and derivatives	Milk, yogurt, and cheese	Proteins, lipids, calcium and vitamins A, B and D
Meats, fish and eggs	Cow, chicken, cod, eggs….	Proteins, lipids, iron, and vitamin B2
'Starchy foods'	Potatoes, rice, bread and pasta.	Carbohydrates, vegetable proteins, vitamin B1 and iron
Fruits and vegetables	Lettuce, tomatoes, grapes, apples, peas ……	Different vitamins and minerals, (depending on the food) carbohydrates,
Pulses and nuts	Lentils, cheek peas, almonds, walnuts…	Different vitamins and minerals (depending on the food), proteins, lipids(nuts)
Fats and oils	Butter, olive oil …	Vitamin A and D. In olive oil there is also vitamin E
Sugars	Sugar and candy	NONE

Activity: Produce a table with 8 foods you often consume and look for the different nutrients those foods contain.

In order to avoid health problems due to an inadequate diet, you should follow the following advices:
Eat a variety of foods: we need to eat food from all groups in order to maintain a balanced diet.
Eat the right amount each and every day: We don't all have the same dietary needs. So it is important to eat the right amount of foods according to your sex, age and life style. As you

should know, when you eat more calories than needed the excess calories will be stored as extra fat in your adipose tissues.
You should eat fruit and vegetable on a daily basis: among other nutrients, fruits and veggies are a good source of vitamins, minerals and fibre. **Dietary fibre** is mainly indigestible plant cellulose which provides the bulk for faeces. Fibre will help push the food along the gut. A shortage of fibre can cause constipation and can also be a factor in the development of bowel cancer. Vitamins can be destroyed easily when heated. Also light or even oxygen in the air can destroy vitamins. That is why is important to include plenty fresh fruits and vegetables in your diet. Fruits and veggies also have antioxidants, which help prevent early aging of cells and cancer. **Alternate eggs, meat and fish as protein sources:** Poultry and game are healthier than read meat, as red meat has more LDH cholesterol, 'bad cholesterol', which accumulates in your arteries causing cardiovascular diseases. Animal fats in general will have more LDH cholesterol than other sources of fats/oils, such as blue fish or nuts. It is also important to remember that too much animal protein could lead to an excess of uric acid in blood, which accumulates in joints causing pain.
What about eggs? How often should we eat eggs?, and how many? There are lots of discrepancy among nutritionists around the world on this issue Eggs are a very nutritious, as they not only have high quality and easily digested proteins, but also minerals, vitamins, etc. So, why do eggs sometime have such a bad reputation?. Let's do our own investigation and try to come up with an educated answer!
Pulses (lentils, garbanzos and other beans), **as well as nuts** are very nutritious and should be eaten daily or often.
Better use vegetable oils than butter, as vegetable oils are a good source of HDL cholesterol and triglycerides, which our system needs. Olive oil is the best choice followed by sunflower seeds oil and then other vegetable oils.
Having a complete breakfast is important as it provides energy for the first hours of the day after fasting all night. It is better to eat smaller amounts of food regularly and more often, than big meals two or three times a day.
Drink 1.5 to 2 litres of water a day. Consume salt with moderation.
Avoid alcohol as it is toxic for the nervous system as well as for the liver.
Avoid 'junk food', such as processed food, sodas, and other non-nutritious snacks, containing lots of saturated fats, additives, flavour enhancers (such as MSG), and salt, among others.

Mediterranean diet

What is the Mediterranean diet?

A Mediterranean diet is defined as the traditional diet that is used in the countries surrounding the Mediterranean Sea and it is considered to be one of the healthier and most well balanced diets.

The common Mediterranean dietary pattern has these characteristics:

- high consumption of fruits, vegetables, bread and other cereals (complex carbohydrates), potatoes, beans, nuts and seeds.
- olive oil is an important monounsaturated fat source compared to saturated fats found in animal products such as butter.
- dairy products, fish and poultry are consumed in low to moderate amounts, and little red meat is eaten
- eggs are consumed three to five times a week
- wine is consumed in low to moderate amounts

The benefits from this diet are:

It prevents circulatory system illnesses due to high cholesterol, constipation (or even finding it difficult to go to the toilet), colon cancer or obesity. The variety in this diet has a worldwide reputation for its high standards.

Diseases related to eating habits

Obesity: Obesity means having too much body fat. Fat accumulates in the adipose tissue under the skin and around the organs which results in a person's weight greater than what's considered healthy for his or her height. Obesity occurs over time when you eat more calories than you use. The balance between calories-in and calories-out differs for each person. Factors that might affect your weight include your genetic makeup, overeating, eating high-fat foods, and not being physically active. Obesity, among other health complications, often leads to type 2 diabetes. (Nlm.nih.gov, 2015)

Diabetes, anorexia and bulimia are other diseases directly or indirectly related to a poor diet and you will do some research and activities in order to understand them better.

Activities:

Name three important nutrients.
How many different amino acids are there? Amino acids are the subunits of a very important macromolecule; what is the name of that macromolecule?
What are the building units of complex carbohydrates called?
Why are minerals important for our health? And vitamins?
What are some diseases directly related to an unhealthy diet?
Why do we need to eat carbohydrates?
Give 3 biological functions of proteins.
Why do we need to eat?

References

Cabrera Calero, A. (2011). *Biology and geology, ESO 3*. [San Fernando de Henares]: Oxford Educación.

Childrensuniversity.manchester.ac.uk, (2015). [online] Available at: http://www.childrensuniversity.manchester.ac.uk/media/services/thechildrensuniver sityofmanchester/flash/digestive.swf [Accessed 13 Apr. 2015].

Passmyexams.co.uk, (2015). *Pass My Exams: Easy exam revision notes for GSCE Physics and Biology*. [online] Available at: http://www.passmyexams.co.uk/index.html [Accessed 13 Apr. 2015].

Pickering, W. (2006). *Complete biology for IGCSE*. Oxford [England]: Oxford University Press.

Yakult.com.au, (2015). [online] Available at: http://www.yakult.com.au/resources/flash/flash_digestiveDD100.swf [Accessed 13 Apr. 2015].