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Don’t Worry, Be Healthy – Life Management

INTRODUCTION

Key concepts:
Nutrients, oxidation, digestion, the reason for energy needs, calories, weight, body control, diet, basic metabolic rate, carbohydrates, fats, proteins, minerals, vitamins.

This simulation activity is aimed at students aged 12–14 years studying basic level biology. It is designed to help students understand the connection between consumption, physical activity, and weight.

- Every part of our daily diet has an energy content, dependent on the molecular construction of the basic ingredients (lipids, carbohydrates, proteins, nucleic acids).
- The reason for the different energy levels of the particular food types is the varying composition of their basic molecular ingredients. It can be described as the weighed sum of the energy content of the different components.
- All of our daily physical activities are part of our daily energy consumption and these can also be described with thermodynamical values.
- The body uses energy for physical activity from the metabolic reactions of the basic molecules.
- The cause of increasing body weight and fat content is the imbalance of energy input versus energy output.
- The reason we measure both sides is to find the right balance between nutrition and physical activity in order to avoid health problems.

RESOURCES

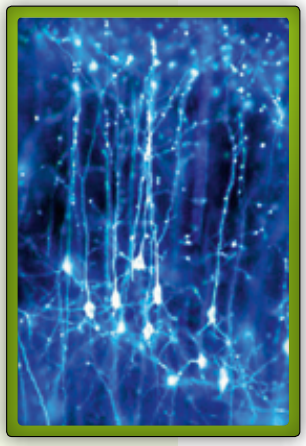
Our database: A detailed list of the energy content of the most common foods' raw components (cereals, vegetables, meat types, cheeses, etc.) and that of processed foods. It also contains the energy consumption rate of the most frequent daily (physical) activities. There are also questionnaires for monitoring the meal consumption (weekly diet) as well as actual physical activity logs. The program calculates a daily/weekly energy equilibrium rate from the comparison of energy input (food uptake) versus output (physical activity). The program and the detailed list of the energy content will be available at www.science-on-stage.de.

CORE

Life management is an interdisciplinary subject. With the help of this project we can teach biology, chemistry, physics, maths or ICT to our students. We recommend it for students aged 12–14 years. In Europe, subjects on diet or sports are always popular. We can make it interesting using many experiments and programs. In this project we focused on ICT, with the main parts called 'input', 'analysis' and 'output-visualisation'.

Relation to curriculum:
Biology, Physics, Chemistry, Maths and ICT.

Teaching part: from food to life
We need a lot of energy simply to live. We need energy for all of our movements, for a constant body temperature, to build our body, for our metabolism, even for brain activity.



We gain all this energy from the combustion of nutrients; more precisely, from the oxidation of the nutrients. First of all, the outside nutrients have to get into our cells. You've already learnt about this process – digestion – in previous classes. This unit is about energy needs, calories, foods, weight, body control, and diet. As everybody knows, there is a linear relationship between eating more and getting fatter. With this program you will get a clearer picture of how you can establish your food's energy content and the energy you consume during motion. After going through this program, you should be able to manage your weight long-term.

The Basic Metabolic Rate
Your body is burning energy all the time, not just when you are physically working or exercising, but even when you are resting or sleeping. The Basal Metabolic Rate (or BMR) works in the background of energy consumption, just to maintain your breathing, circulation and metabolism.

For most people the BMR accounts for the majority of the calories burned. As you get older, other things remaining

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constant, your BMR will decrease. The body controls the rate of metabolic energy consumption mainly through the hypothalamus, which is located in the brain stem. This process is completely autonomous, although it can be affected by our mood, stress or excitement, and also by the environment, while the body maintains a constant temperature.

The Basal Metabolic Rate

	kcal/day
female	
0–2	61 × body mass - 51
3–9	22.5 × body mass + 499
10–17	12.2 × body mass + 746
18–29	14.7 × body mass + 496
30–59	8.7 × body mass + 829
≥60	10.5 × body mass + 596
male	
0–2	60.9 × body mass - 54
3–9	22.7 × body mass + 495
10–17	17.5 × body mass + 651
18–29	15.3 × body mass + 679
30–59	11.6 × body mass + 879
≥60	13.5 × body mass + 487

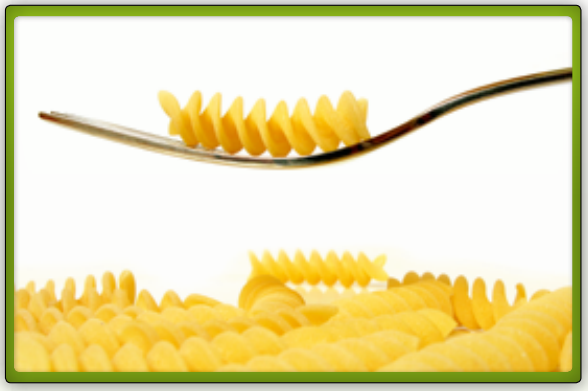
The formula for BMR uses variables such as gender, height, weight and age to predict the speed at which we burn calories when at rest. It does not take into account your body fat composition. In reality, a person of a heavy muscular build will have a higher BMR than a person of the same weight, carrying more fat. The body requires an additional 16 calories a day for each pound of lean muscle, or 35 calories per kilogram. The difference in the formulae for men and women is mainly due to the different amounts of fat tissue in the bodies of males compared to females.

The inputs

The inputs are the variety of foods we eat. Foods are from nutrients. Let's have a look at them!

Kinds of nutrients

The foods we eat contain thousands of different chemicals. However, only a few dozen of these chemicals are absolutely essential to keeping us healthy. These are the nutrients - the substances we must obtain from the foods we consume. Nutritionists classify nutrients into six main groups: water, carbohydrates, fats, proteins, minerals, and vitamins.



Carbohydrates include all sugars and starches. They serve as the main source of energy for living things. Each gram of carbohydrates provides about 4 calories (a gram is about 0.035 ounce). There are two kinds of carbohydrates - simple and complex. Simple carbohydrates, all of which are sugars, have a simple molecular structure. Complex carbohydrates, which include starches, have a larger and more complicated molecular structure that consists of many simple carbohydrates linked together.

Most foods contain carbohydrates. The main sugar in food is sucrose, which is the component of both ordinary white sugar and brown sugar.

Another important sugar – lactose – is found in milk. Fructose, an extremely sweet sugar, comes from most fruits and many vegetables. Foods containing starches include beans, breads, cereals, corn, pasta (macaroni, spaghetti, and similar foods made of flour), peas, and potatoes.

Fats are a highly concentrated source of energy. Each gram of fat provides about 9 calories, but you cannot live without it either.

Certain polyunsaturated fatty acids must be included in the diet because the body cannot manufacture them.

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These essential fatty acids serve as building blocks for the membranes that surround every cell in the body. Polyunsaturated fatty acids are found in the oils of plants such as corn and soybeans as well as in fish such as salmon and mackerel. Common sources of monounsaturated fatty acids include olives and peanuts. Most saturated fatty acids are contained in foods derived from animals, such as butter, lard, dairy products, and fatty red meats.

Proteins provide energy. Like carbohydrates, they contain 4 calories per gram but more importantly, proteins serve as one of the main building blocks of the body. Muscle, skin, cartilage, and hair, for example, are made up largely of proteins. In addition, every cell contains proteins called enzymes, which speed up chemical reactions. Cells would not be able to function without these enzymes. Proteins also serve as hormones (chemical messengers) and as antibodies (disease-fighting chemicals).

The best dietary sources of protein are cheese, eggs, fish, lean meat, and milk. The proteins in these foods are called complete proteins because they contain adequate amounts of all the essential amino acids. Cereal grains, legumes (plants of the pea family), nuts, and vegetables also supply proteins. These proteins are called incomplete proteins because they lack adequate amounts of one or more of the essential amino acids.

Minerals and **vitamins** are very important for a healthy life, too, but our main focus is on energy input.

Calculating the energy value of food

The energy value signifies the calories contained in a certain food and is expressed in kJ. Our database contains the amount of energy in 100 g (or 100 cm^3) of food. Then you have to calculate how much energy is in the given amount of food. For example if the food's weight is 250 g, and 100 g means 1200 kJ, you have to multiply 1200 kJ by 2.5. If the food is not listed in the database you might find its energy per 100 g on its label. If you eat a homemade sandwich, you have to calculate all of its contents separately and then add them up. You can do this with a program.

Physical activities

Every kind of physical activity needs energy. Energy consumption depends on your body's condition, the intensity of your activity, and, of course, the amount of time you spend doing it. Some of the activities are hard to calculate, some (such as walking on a treadmill) are easier. With the program you can use our second database, which contains examples indicating the amount of kJ you burn per hour of activity.

Project homework

Please register your daily energy input and physical activity, subtract your BMR, and count your energy balance with the help of our program. Extend the databases of exercises and foods as needed.

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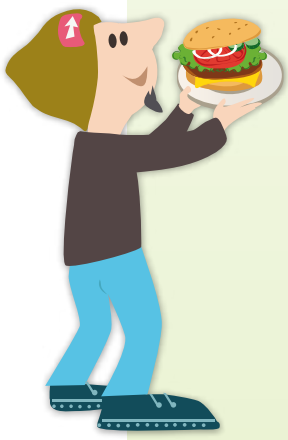
CONCLUSION

The final step is to make a diet recommendation taking into account the energy provided by each food type. The recommendation is based upon the daily activity, the latter of which is entered in the questionnaire. It should contain the explanation of the diet, which is also entered (how healthy it is and why) and an explanation on the diet change based upon the nutrition recommendations.



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