**ACTIVITY: Calculating RMR and daily energy output**

**Activity idea**

In this activity, students calculate their RMR (resting metabolic rate) and use this to calculate the energy cost of various activities. From these values, an estimate of their average daily energy expenditure can be made.

By the end of this activity, students should be able to:

* explain the meaning of resting metabolic rate (RMR)
* calculate an approximate value for their resting metabolic rate
* understand the concept of metabolic equivalents and how it is used
* estimate their average daily energy expenditure.

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Student worksheet: [Calculate your daily energy output](#calculate)

**Introduction/background**

Resting metabolic rate (RMR) is the energy required to perform essential body functions such as breathing and heart rate while the body is at rest in a fasting state.

In recent times, nutritionists have developed several prediction equations to estimate RMR from simple body measures such as body mass, age and gender.

The energy cost of different types of physical activity can be determined by the amount or duration of the activity, the type of activity (such as walking, running, cleaning the house) and the intensity at which the activity is performed.

One way of reporting the energy cost of such activities is by using metabolic equivalents (METs), which represent multiples of RMR. For example, sitting quietly after a 12-hour fast is equivalent to 1 MET, whereas walking at a moderate pace is about 3 MET.

By firstly calculating their RMR and then determining the energy cost of various activities in a typical school day, students can estimate their daily energy output.

**What you need**

* Copies of the student worksheet: [Calculate your daily energy output](#calculate)
* Scales to determine body mass in kg
* Calculator

**What to do**

1. Hand out copies of the student worksheet and read through together to ensure students understand the task.
2. Have students complete the worksheet and discuss the results. A more accurate value for average daily energy cost can be determined by keeping a daily log of type, duration and intensity of activities over a typical school week, which can then be used to calculate the weekly energy cost and then the average daily cost.

**Calculate your daily energy output**

Resting metabolic rate (RMR) is the energy required to perform essential body functions such as breathing and heart rate while the body is at rest in a fasting state. In recent times, nutritionists have developed several prediction equations to estimate RMR from simple body measures such as body mass, age and gender.

***Estimating RMR from body mass***

|  |  |  |
| --- | --- | --- |
| **Age (years)** | **Equation for males** | **Equation for females** |
| 0–3 | (60.9 x body mass) - 54 | (61.0 x body mass) - 51 |
| 3–10 | (22.7 x body mass) + 495 | (22.5 x body mass) + 499 |
| 10–18 | (17.5 x body mass) + 651 | (12.2 x body mass) + 746 |
| 18–30 | (15.3 x body mass) + 679 | (14.7 x body mass) + 496 |
| 30–60 | (11.6 x body mass) + 879 | ( 8.7 x body mass) + 829 |
| >60 | (13.5 x body mass) + 487 | (10.5 x body mass) + 596 |

The energy cost of different types of physical activity can be determined by the amount or duration of the activity, the type of activity (such as walking, running, cleaning the house) and the intensity at which the activity is performed.

One way of reporting the energy cost of such activities is by using metabolic equivalents (METs), which represent multiples of RMR. For example, sitting quietly after a 12-hour fast is equivalent to 1 MET, whereas walking at a moderate pace is about 3 MET.

***Metabolic equivalent (MET) values for various activities***

|  |  |  |  |
| --- | --- | --- | --- |
| **Activity** | **METs** | **Activity** | **METs** |
| Basketball | 8 | Playing a musical instrument | 2–4 |
| Cleaning the house | 2–4 | Rowing | 12–18 |
| Cycling for pleasure | 8 | Rugby | 6–10 |
| Cycling for competition | 10–18 | Running slowly (8–11km/h) | 8–10 |
| Gardening | 5 | Running quickly (14–16km/h) | 16–18 |
| Gym workout | 6 | Soccer | 7–10 |
| Hockey | 7–10 | Tennis | 6–8 |
| Kayaking | 5–10 | Swimming laps | 6–12 |
| Mowing the lawn (power mower) | 4.5 | Walking | 3–5 |
| Netball | 6–8 |  |  |

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| --- | --- | --- | --- | --- | --- | --- |
| 1. Determine your body mass to the nearest 0.1kg | | | | | kg |  |
| 1. Use the correct equation for estimating RMR to calculate your RMR. For example, a 14-year-old teenage girl with a body mass of 50kg:   RMR = (12.2 x 50) + 746  = 1,356 calories/day x 4.18 to convert to kilojoules = 5,668 kJ/day  **Your RMR** | | | | | | kJ |
| 1. Select a typical school day and note duration and intensity of all physical activities that you engaged in. For example, for the 14-year-old teenage girl above, 1 hour of moderate walking rated at 3 MET would have an energy cost of 3 x (5668 ÷ 24) = 708.5 kJ. | | | | | |  |
| **Type of activity** | **Duration (hours)** | **Intensity** | **METs** | **Energy cost** | | kJ |
| *e.g. Walking* | *1 hour* | *Moderate* | *3* | *708.5kJ* | |
|  |  |  |  |  | |
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|  |  |  |  |  | |
|  |  |  |  |  | |
| **+ your energy cost from activities** | | | | | |
| **= your total daily energy output** | | | | | | kJ |