



## Demystifying metabolism

Metabolism refers to the countless chemical processes going on continuously inside the body that have the purpose of providing energy for the vital activities and processes and thus allow life and normal functioning. These processes require energy from food. The amount of calories your body burns at any given time is regulated by your metabolism. The metabolic rate is the rate of energy production and expenditure at a given moment.



### Two processes of metabolism:

The two complementary processes of metabolism are:

- **Catabolism** - the breakdown of food components (such as carbohydrates, proteins and fats) into their simpler forms, which can then be used to create energy. This immediate form of energy can be converted into heat or burned by cells (cellular respiration).
- **Anabolism** - energy is stored in fat cells or used to help build and repair structures of the body.

The body's metabolism is governed by hormones (chemical messages secreted by the glands of the endocrine system) and the nervous system. The rates of catabolism and anabolism are carefully monitored to make sure they remain in balance. Metabolism can be upset by a variety of events, including genetic disorders and hormonal problems.

### Metabolic rate (or total energy expenditure):

The body's metabolic rate (or total energy expenditure) is divided into three states:

- **Basal metabolic rate (BMR)** - is the amount of calories burned at rest and contributes 50 - 70 per cent of our energy needs.
- **Energy expenditure in physical work** - is the amount of calories burned during movement and physical activity; it contributes at least 20 per cent of our energy needs and it is also known as the "thermic effect of exercise"
- **Energy expenditure associated with eating, digesting and metabolising food** - also known as the "thermic effect of food"; it contributes about 5 - 10 per cent of our energy needs.

The first two states are proportional to body weight. A person with a high body weight has a relatively high BMR because of a larger amount of muscle required to carry the larger body. This person will also have a higher rate of energy expenditure in movement activities, such as walking and most physical work. The opposite is true for a person of light weight.

### Factors affecting the BMR:

A person's BMR is influenced by a number of factors working in combination, including:

- **Body size** - larger adult bodies have more metabolising tissue and a larger BMR.
- **Age** - metabolism slows with age, due to a loss in muscle tissue but also due to hormonal and neurological changes. Beyond maturity there is a gradual fall in BMR per kilogram body weight of about 10 per cent per year.

- **Growth** - infants and children have higher energy demand per unit of body weight due to the energy demand for growth and the energy demand for maintenance of body temperature.
- **Gender** - generally, men have faster metabolisms than women because they tend to be larger and have less body fat.
- **Genetic predisposition** - the metabolic rate may be partly decided by a person's genes.
- **Amount of lean muscle tissue** - muscle burns calories voraciously.
- **Amount of body fat** - fat cells are sluggish and hardly burn any calories at all; they need next to no energy to maintain themselves.
- **Hormonal and nervous controls** - BMR is controlled by the nervous and hormonal systems; hormonal imbalances can influence how quickly or slowly the body burns calories.
- **Dietary deficiencies** - for example, a diet low in iodine reduces thyroid function, which slows the metabolism.
- **Environmental temperature** - if temperature is very low or very high, the body has to work harder to maintain its normal body temperature, thus increasing the BMR.
- **Infection or illness** - BMR increases because the body has to work harder to build new tissues and to create an immune response.
- **Crash dieting, starving or fasting** - eating too few calories encourages the body to slow the metabolism to conserve energy; BMR can drop by up to 15 per cent. Spontaneous activity is also reduced, achieving a further 15 per cent reduction in energy expenditure. These two combine to reduce energy usage and to conserve life. There is also loss of lean muscle tissue, which further contributes to the drop in BMR.
- **Amount of physical activity** - hard working muscles need plenty of energy to burn. Regular exercise increases muscle mass and 'teaches' the body to burn calories at a faster rate, even when at rest.
- **Drugs** - some drugs, like caffeine or nicotine, can increase the BMR.

### Age-related weight gain

Muscle tissue has a voracious appetite for calories. The more muscle mass you have, the more calories you will burn. People tend to put on fat as they age - this is because the body slowly loses muscle. It is unknown how much lost muscle is attributable to the ageing process itself or to decreased activity levels. Strength and resistance training can reduce or prevent the decline in muscle mass that is generally observed with ageing. If you are over 40 years, have a pre-existing medical condition or haven't exercised in some time, see your doctor before embarking on any new fitness program.

### Hormonal disorders

Hormones help to regulate the metabolism. Some of the more common hormonal disorders are concerned with the thyroid. This gland secretes hormones to regulate many metabolic processes, including energy expenditure (the rate at which calories are burned). Disorders include:

- **Hypothyroidism** - or under active thyroid. The metabolism slows because the thyroid gland doesn't release enough hormones. A common cause is the autoimmune condition Hashimoto's disease. Some of the symptoms of hypothyroidism include unusual weight gain, lethargy, depression and constipation.
- **Hyperthyroidism** - or overactive thyroid. The gland releases greater quantities of hormones than necessary and speeds the metabolism. The most common cause of this condition is Graves' disease. Some of the symptoms of hyperthyroidism include increased appetite, weight loss, nervousness and diarrhoea.

### Genetic disorders of metabolism

Sometimes a faulty gene affects part of the metabolic process and stops the body from using food

components, such as carbohydrates, in the normal way. In most cases, these disorders can be managed under medical supervision, with strict attention to diet. Some inborn errors of metabolism include:

- **Fructose intolerance** - the inability to break down fructose, which is a type of simple sugar found in fruits, fruit juices, sugar (for example, cane sugar) and certain vegetables.
- **Galactosaemia** - the inability to convert the carbohydrate galactose into glucose. Galactose is not found in nature; it is produced when lactose is broken down by the digestive system into glucose and galactose. Sources of lactose include milk and milk products, such as yoghurt and cheese.
- **Phenylketonuria (PKU)** - the inability to convert the amino acid phenylalanine into tyrosine. High levels of phenylalanine in the blood can cause brain damage. High protein foods must be avoided.

**Things to remember:**

- Metabolism refers to the countless chemical processes going on continuously inside the body that allow life and normal functioning.
- The amount of calories your body burns at any given time is regulated by metabolism.
- The metabolic rate is influenced by many factors, including age, gender, muscle-to-fat ratio, amount of physical activity and hormone function.