

• • • Your 'at a glance' guide to staying healthy for life By Quest Vitamins • • •

Hectic life-styles have resulted in food being relegated to a low priority necessity, often grabbed "on the run" with an emphasis on convenience rather than nutrition; in these circumstances it is hardly surprising that most people complain of chronic tiredness. Nutrients are an intrinsic part of the process of generating energy, a lack of these nutrients can result in tiredness, exhaustion and lethargy.

The production of energy requires carbohydrate, fat and protein; a range of vitamins and minerals must also be available to support various stages of the process.

Carbohydrate

The digestive system converts the carbohydrates in food into glucose, a form of sugar carried in the blood and transported to cells for energy. The brain needs a constant supply of glucose. Any glucose not used by the cells is converted into glycogen - another form of carbohydrate that is stored in the muscles and liver.

Carbohydrate fuels high intensity, short duration exercise like sprinting.

Fat

Fats are energy rich, each gram of fat supplies the body with about 9 calories, more than twice that supplied by proteins or carbohydrates. Because fats are such an efficient form of energy, the body stores all forms of excess energy as fat.

Fat is slow to digest and be converted into a usable form of energy. Fat is broken down to produce **acetyl CoA**, which begins the process of energy generation. The use of fat for energy requires a lot of oxygen, it is an important fuel source for longer duration, less intense exercise like walking.

Protein

Proteins consist of units called amino acids, strung together in complex formations. Protein, is the main building block in the body, is the primary component of most cells including muscle, connective tissues, and skin. If the body doesn't have enough carbohydrate, protein is broken down to make glucose; amino acids are converted to **acetyl CoA**. The final products of protein breakdown include carbon dioxide, water, urine, ammonia and energy.

Key Nutrients For Energy:

- ✓ Thiamin
- ✓ Riboflavin
- ✓ Niacin
- ✓ Pantothenic acid
- ✓ Vitamin B6
- ✓ CoEnzyme Q10
- ✓ Iron

Nutrients and energy

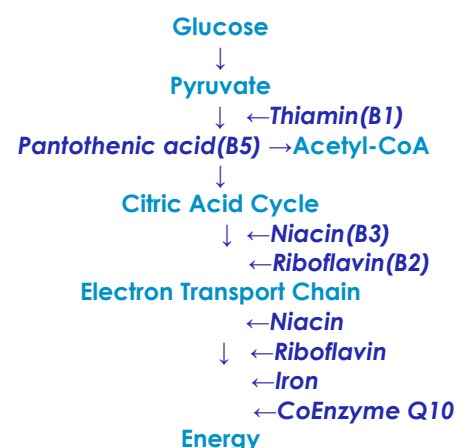
Energy production from dietary carbohydrates, fats and proteins is a three stage process:

- **Glycolysis** splits glucose to produce pyruvate.
- When pyruvate is converted to the compound acetyl CoA the **citric acid cycle** begins; it produces nicotinamide adenine dinucleotide (NAD) and flavin adenine dinucleotide (FAD).

NAD and FAD carry "high energy" electrons, which are passed along to oxygen, generating energy in the process (this is called the "**electron transport chain**").

Nutrients are required at each stage, as demonstrated in the illustration:

NUTRIENTS AND ENERGY



Nutrients are required at each stage, as demonstrated in the above table

Information created by Quest Vitamin's Nutritionist. Questions and Comments please email us; nutritionists@questvitamins.co.uk

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Vitamins act as coenzymes; enzymes are substances that initiate (catalyse) chemical reactions, they require assistants in the form of coenzymes.

Thiamin (vitamin B1)

In the body thiamine is found as thiamine diphosphate (TDP).

The conversion of **pyruvate** to **acetyl-CoA**, a reaction that begins the citric acid cycle, is TDP dependant. TDP is also required for the formation of acetyl-CoA from protein, which is used to make energy. The breakdown of fat for fuel also requires acetyl-CoA produced with the help of TDP.

Riboflavin (vitamin B2)

In the body riboflavin is primarily found as an integral component of the coenzymes FAD and FMN. These coenzymes are integral to both the **citric acid cycle** and the **electron transport chain**.

Niacin (vitamin B3)

A derivative of niacin is used to form NAD and NADP. As many as 200 enzymes require NAD and NADP.

Pantothenic acid (vitamin B5)

Pantothenic acid is a component of coenzyme A (CoA), making it integral to the **citric acid cycle** and the use of fat and protein as energy sources.

Vitamin B6

The active form of the vitamin is pyridoxal-5-phosphate (PLP). PLP functions as a coenzyme for glycogen phosphorylase, an enzyme that catalyzes the release of **glucose** from liver carbohydrate stores (glycogen). The vitamin is also coenzyme in the reaction that synthesizes niacin from the amino acid tryptophan.

CoEnzyme Q10

Coenzyme is the final electron acceptor in the **electron transport chain**.

Iron

Iron is an electron acceptor in the **electron transport chain**. Iron's role in energy is also as the haem part of the compound haemoglobin in red blood cells, which transports oxygen to tissues.

Magnesium

More than 300 metabolic reactions require magnesium to function; ATP, the molecule that provides energy for almost all metabolic processes, exists primarily as a complex with magnesium (MgATP). The mineral has a principal role in regulating muscle contraction.

Carnitine

Carnitine is a nutrient responsible for the transport of long-chain fatty acids into the energy-producing centers of the cells (known as the mitochondria).

Glutamine

Glutamine is an amino acid stored mostly in muscle. It is the primary source of fuel for enterocytes (cells lining the inside of the small intestine)

The efficient generation of energy from foods is dependant on a number of key nutrients. Ensuring optimum intake can restore vitality and help fight fatigue.

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