

Minerals and health



By April Cashin-Garbutt, MA (Editor)

Minerals are nutrients that are essential for the body. (1) There are 22 of them in total. (2)

Types of minerals

Minerals can be broken down into two types: macro-minerals and micro-minerals. (2) They are also sometimes referred to as major minerals and minor (or trace) minerals. (1, 3)

Macro-minerals (Major minerals)

The macro-minerals include:

- Calcium
- Phosphorus
- Magnesium
- Sodium
- Chloride
- Potassium
- Sulfur (1, 2)

Macro-minerals, in particular calcium and phosphorus, tend to play structural roles within the body. (2)

The body needs over 100mg per day of each macro-mineral. (1) This may sound like a large amount, but it can be put in perspective by considering that a dollar bill weighs 1000mg. (4)

Calcium

Most of the body's calcium is used to keep the bones and teeth strong. Some calcium is also needed to regulate the heart beat along with other muscle functions. Calcium is also used in other metabolic functions such as nerve transmission and intracellular signalling.

According to the NHS adults need 700mg of calcium per day. This should be able to be consumed in a healthy diet. Dairy products and some green leafy vegetables (not spinach) are high in calcium. (5, 6)

Phosphorus

Phosphorus is also used to make the bones and teeth strong. This is because phosphorus is found in the bones in hydroxyapatite, a calcium phosphate salt.

Phosphorus is also used in the body for many other purposes. It is the main structural constituent of cell membranes. It is also found in genetic material such as DNA and RNA.

Phosphorus also has an important role in supplying the body with energy. One of the most well-known energy compounds that contain phosphorus is adenosine triphosphate (ATP). This molecule can store energy in its bonds. When these bonds are broken the energy is released and can be used to power energy-requiring processes. (7, 8, 9)

According to the NHS adults need 550mg of phosphorus per day. Again this should be consumable through a healthy diet. Red meat, dairy products and fish all contain high levels of phosphorus. (10)

Magnesium

Magnesium is used in over 300 biochemical reactions in the body. It helps to convert carbohydrates and fats into energy. It is also used in the synthesis of proteins and nucleic acids, such as DNA and RNA. Magnesium is also used in cell signalling.

In addition, magnesium has a structural role, particularly in the teeth and bones.

The amount of magnesium you require depends on your sex. According to the NHS men need 300mg per day; whereas women require only 270mg. Magnesium is found in whole grains, nuts and green leafy vegetables. (10, 11, 12, 13)

Sodium

Sodium helps to control water balance in cells, and also blood volume and blood pressure. It is also involved in nerve impulses.

According to the NHS we should consume no more than 2.4g of sodium (this relates to 6g of salt - sodium chloride). Many people struggle with consuming less than 2.4g of sodium. This may be because sodium is found in processed foods. (10, 14, 15)

Chloride

Chloride is important for digestion, as it forms hydrochloric acid in the stomach. This acid helps to destroy harmful bacteria that may be brought in on food. (16, 17)

The amount of chloride required by the body depends on your age. Adolescents and adults under 50 should intake 2.3 grams per day. Older people require progressively lower amounts. (18)

Potassium

Potassium, like sodium, helps to control the water balance of the body. Recent research has also suggested that potassium may help to reduce blood pressure. (10, 19)

According to the NHS, it is necessary for adults to intake 3,500mg of potassium per day. Good sources of potassium include meats, some fish, dairy products and fruit and vegetables. (10, 20)

Sulfur

Sulfur is needed in the production of cartilage and other tissues.

A recommended dietary allowance for sulphur does not exist; however the Department of Health advises that adequate sulphur requirements can be gained from a healthy diet. Sulfur-rich foods are those that contain protein, such as meat, fish and so forth. (10, 21)

Micro-minerals (Trace minerals)

There are more than 12 micro-minerals. The main ones are:

- Iron
- Copper
- Zinc
- Manganese
- Iodine
- Selenium (4)

Micro-minerals are not needed in as high amounts as macro-minerals, as they are generally used as catalysts in enzyme reactions. (2)

More specifically, the body needs less than 100mg per day of each micro-mineral. (4)

Iron

Iron is involved in carrying oxygen around the body. It does this by helping to form haemoglobin molecules in the blood, and myoglobin molecules in the muscles. (23)

The amount of iron adults should intake depends on their sex. According to the NHS, men should consume 8.7mg of iron per day; whereas women should intake 14.8mg. Foods that contain iron include liver, meat and dark green leafy vegetables. (22)

Copper

Copper is important for iron metabolism. This is because it oxidises iron to the form that is necessary for red blood cell formation. Copper is also used by the body to fight off free-radicals. (24)

According to the NHS, it is necessary for adults to consume 1.2mg of copper per day. This can be achieved by consuming nuts, shellfish and offal. (10)

Zinc

Zinc is important for wound healing. It is also involved in many metabolic processes as it forms part of many enzymes.

According to the NHS, the amount of zinc that adults require depends on their sex. Men require between 5.5- 9.5 mg of zinc per day; whereas, women require 4-7mg per day.

Zinc can be found in red meat and poultry, in addition it can be consumed from many cereals which are fortified with zinc. (10, 25)

Manganese

Manganese forms part of an enzyme present in the mitochondria of cells. This enzyme, known as manganese superoxide dismutase (MnSOD), is responsible for fighting free-radicals.

Manganese is also a component of other metabolic enzymes and it is necessary for the production of healthy bones and also collagen which is used in wound healing. (26, 27)

Manganese is found in several sources including tea, nuts and cereals. (10) According to the Food and Nutrition Board (FNB) of the Institute of Medicine, men over the age of 18 should intake 2.3mg of manganese per day; whereas women (over 18) should consume 1.8mg per day. (28)

Iodine

Iodine is used in the production of thyroid hormones, such as triiodothyronine (T3) and thyroxine (T4). Thyroid hormones affect many systems in the body including the brain, skeleton and organs.

According to the NHS adults should consume 0.14mg of iodine per day. Iodine is present in sea fish and shellfish. It is also found in some grains – although this may depend on the type of soil in which the plants are grown. (29, 30, 31)

Selenium

Selenium forms selenoproteins in the body, which are proteins associated with selenium. There are at least 25 different selenoproteins with many different functions. These include regulating thyroid hormones, defending against oxidative stress, regulating cell growth, aiding spermatogenesis and so forth. (32, 33)

The amount of selenium you need to consume depends on your sex. According to the NHS, men need 0.075mg per day; whereas women need only 0.06mg per day. This can be consumed through meat, fish and nuts – particularly brazil nuts. (10)

Other micro-minerals

Other micro-minerals include:-

- beta-carotene
- boron
- chromium
- cobalt
- fluoride
- molybdenum
- nickel
- silicon (2, 10)

Sources

1. <http://www.najah.edu/>
2. http://dining.unt.edu/nutrition/nutrition_brochures/Minerals.pdf
3. <http://web.mit.edu/athletics/sportsmedicine/wcrminerals.html>
4. http://facweb.northseattle.edu/sbusch/Lecture_13.pdf
5. <http://www.nhs.uk/Conditions/vitamins-minerals/Pages/Calcium.aspx>
6. <http://ods.od.nih.gov/factsheets/Calcium-HealthProfessional/>
7. <http://www.umm.edu/altmed/articles/phosphorus-000319.htm>
8. <http://lpi.oregonstate.edu/infocenter/minerals/phosphorus/>
9. Lodish, Berk et al. (2004) Molecular Cell Biology Fifth Edition. W.H. Freeman and Company
10. www.nhs.uk/.../Other-vitamins-minerals.aspx
11. <http://ods.od.nih.gov/factsheets/Magnesium-HealthProfessional/>
12. <http://www.umm.edu/altmed/articles/magnesium-000313.htm>

13. <http://lpi.oregonstate.edu/infocenter/minerals/magnesium/>
14. http://extension.usu.edu/files/publications/publication/FN_220.pdf
15. <http://www.ext.colostate.edu/pubs/foodnut/09354.html>
16. http://www.nal.usda.gov/fnic/DRI/DRI_Water/269-423.pdf
17. www.bbc.co.uk/science/humanbody/body/factfiles/stomach/stomach.shtml
18. <http://www.umm.edu/ency/article/002417rec.htm>
19. <http://www.ext.colostate.edu/pubs/foodnut/09355.html/>
20. <http://www.umm.edu/altmed/articles/potassium-000320.htm/>
21. http://www.health.harvard.edu/newsweek/Listing_of_vitamins.htm
22. <http://www.nhs.uk/Conditions/vitamins-minerals/Pages/Iron.aspx>
23. http://www.mckinley.illinois.edu/handouts/dietary_sources_iron.html
24. <http://lpi.oregonstate.edu/infocenter/minerals/copper/>
25. <http://ohioline.osu.edu/hyg-fact/5000/5560.html>
26. <http://www.csua.berkeley.edu/~wuhsi/elements.html>
27. <http://lpi.oregonstate.edu/infocenter/minerals/manganese/>
28. iom.edu/.../RDA%20and%20AIs_Vitamin%20and%20Elements.pdf
29. <http://lpi.oregonstate.edu/infocenter/minerals/iodine/>
30. <http://www.nhs.uk/Conditions/vitamins-minerals/Pages/Iodine.aspx>
31. <http://e.hormone.tulane.edu/learning/thyroid.html>
32. <http://lpi.oregonstate.edu/infocenter/minerals/selenium/>
33. http://www.nap.edu/openbook.php?record_id=9810&page=285

Further Reading

- [All Minerals Content](#)

Last Updated: Jun 25, 2019



Written by

April Cashin-Garbutt

April graduated with a first-class honours degree in Natural Sciences from Pembroke College, University of Cambridge. During her time as Editor-in-Chief, News-Medical (2012-2017), she kickstarted the content production process and helped to grow the website readership to over 60 million visitors per year. Through interviewing global thought leaders in medicine and life sciences, including Nobel laureates, April developed a passion for neuroscience and now works at the Sainsbury Wellcome Centre for Neural Circuits and Behaviour, located within UCL.