



# Lesson 7:

## Minerals

### Introduction to Minerals



Dietary minerals are naturally occurring, crystalline substances required for proper function of the human body.

Minerals are required for proper function, including:

- Enzyme cofactors
- Acid-base balance regulation
- Nerve conduction
- Muscle contraction
- Heartbeat and rhythm
- Blood clotting
- Blood pressure regulation
- Fluid balance
- Transportation of gasses to and from the cells, including the all important oxygen
- Growth and tissue repair
- Teeth and bone health
- Stomach acid production
- Hormone production, especially thyroid hormones

Minerals can be found throughout the body, and abundantly in bone, blood, tissue, and enzymes.

The average human body consists of about 4% mineral matter, the majority of which is stored in the bones, and mostly consisting of calcium and phosphorus.



Minerals are very stable substances that are not destroyed by light, water, heat or other processes. Ashes are the minerals of any given substance after it has been completely burned. When a body is cremated all that is left is about 5 pounds of ashes; essentially all the minerals (elements) that made up that body.

Minerals as % of body weight

Calcium	2.0%
Phosphorus	1.2%
Potassium	0.4%
Sulfur	0.2%
Sodium	0.2%
Chloride	0.2%
Magnesium	0.05%
Iron	0.04%

The human body is not able to produce minerals and must obtain them all from the diet. As has been stressed throughout this course, the best dietary source of nutrition, including minerals, is obtained from eating a variety of whole foods, preferably sourced as local as possible.

In 2003, D. Thomas published “A study on the mineral depletion of the foods available to us as a nation over the period 1940 to 1991” which tracked the chemical composition of several food categories over 50 years and found a significant loss in mineral and trace elements. [[ncbi.nlm.nih.gov/pubmed/14653505](https://ncbi.nlm.nih.gov/pubmed/14653505)]

While many dispute this study, we must consider that modern living conditions, food manufacturing and distribution, farming methods and eating habits have changed dramatically in the past 50 years. The majority of people living in Canada today obtain their food from industrialized farming, often shipped in from far off places.

Industrialized farming often relies on synthetic fertilizers and monoculture, both of which can affect the nutritional content of the soil the food is grown in, and consequently the nutrition content of the food itself.

Farmers of the past knew the importance of crop rotation and compost to ensure the soils were not depleted of specific minerals from one year to the next. Organic and permaculture methods of farming are bringing back those wise practices and re-enriching soils. It has been proven that organic produce contains 5% to 15% more minerals than the same food grown using mono-cropping and synthetic fertilizer farming methods.

## Forms of Minerals

Minerals in the food we eat are in two forms: salts or chelates.

Salts are compounds in an ionic form that are negatively charged atoms bound to positively charged atoms. When dissolved in water or other liquids, the bonds dissolve leaving both negatively and positively charged mineral ions. The most well known example of this is sodium chloride, common table salt.



Chelated minerals are minerals that are tightly bound up by a larger molecule. For example magnesium is held, or chelated by, chlorophyll.

For digestion to take place all minerals must be broken down into a usable ionic form – that is they are broken away from their holding partner into individual elements. This process begins in the stomach and completes in the small intestine.

Once freed, the body is able to use minerals in metabolic functions, or store the minerals for later use. If the body's mineral stores are too high, the excess will be excreted in the urine.

Many minerals are absorbed through the same pathways and will compete with each other for absorption. For example magnesium, phosphorus, zinc and manganese absorption is reduced when large amounts of calcium are present. The same thing happens to iron, copper and phosphorus when high levels of zinc are present.

The absorption of minerals through digestion is a complex and not fully understood process. We do know that the lack of hydrochloric acid in the stomach significantly lowers the availability of minerals to be absorbed from food. This becomes especially critical as the body ages and ability to produce hydrochloric acid becomes compromised. Lack of adequate stomach acid can significantly reduce absorption of chromium, manganese, copper, molybdenum, iron, selenium, magnesium and zinc.

## Mineral Supplementation

Like other nutrients, it is best to obtain minerals from food sources. More and more studies are showing that minerals obtained from supplements, especially calcium supplements, can lead to major diseases such as heart disease and arthritis.

When supplementation is required care must be taken to ensure that mineral balances in the body are not thrown off. As we discovered earlier in this lesson, over supplementation of one mineral can block the body from absorbing others.

Mineral supplements come in many forms, such as crude powdered minerals, chelated minerals, mineral salts, dissolved minerals and colloidal preparations.

Opinions differ and manufacturers all claim that their preparation is 'the most absorbable'. The current thought is that a 'chelated' form is best. Chelated mineral supplements have bonded the mineral molecules with protein molecules to help transport them in the blood and increase assimilation. These are called Amino Acid Chelates.

## Electrolytes

Electrolytes are the name given to minerals in blood and other body fluids that carry an electrical charge. Electrolytes must be maintained in balance in the body to ensure proper functioning of muscles, nerve impulses, blood pH, fluid balance and other important processes in the body.

The electrolyte minerals are:

- Sodium



- Chloride
- Potassium
- Calcium
- Magnesium

Electrolytes are lost through sweat, prolonged vomiting, diarrhea, and other excessive loss of body fluids. Electrolyte loss also happens over time through inadequate diet, malabsorption issues, chemotherapy, and medications that impair digestion.

Athletes involved in sports where a lot of sweating happens are particularly vulnerable to electrolyte loss, especially when the sport is done in a hot environment.

Signs of electrolyte imbalance are headache (may come on suddenly,) twitching and other muscle spasms, muscle weakness, confusion, irregular heartbeat, blood pressure changes, fatigue, numbness, and convulsions.

Treatment of electrolyte imbalance is to administer fluids containing properly formulated electrolyte minerals. Drinking water alone is better than nothing at relieving some of the symptoms, however water is not always enough to correct the imbalance.

Sports drinks such as Gatorade and Pedialyte are extremely helpful (even though they are full of sugar and food dye) and should be offered for a quick fix.

If the problem is more severe, intravenous fluids are required.

Babies and children are especially susceptible to electrolyte imbalance and should be checked every hour for signs of dehydration when they are suffering from fever, vomiting and diarrhea.

The World Health Organization's (WHO) basic re-hydration recipe to be used for first aid is as follows:

- 30 ml (6 level teaspoons)sugar
- 2.5 ml (1/2 level teaspoon)salt
- 1 litre (4.25 cups) clean water
- Mix together and drink slowly

½ banana mashed into 1 cup of orange juice with an added pinch of salt can also be used for quick re-hydration.

For a longer term solution to electrolyte imbalance proper nutrition should be observed, including regular ingestion of mineral-rich vegetables and tea. If poor/weak digestive issues are present electrolyte supplementation can be useful until the digestive issues are resolved.

## Heavy Metal Toxicity

There are several minerals that although found in the body in trace amounts, can cause major health issues in larger quantities. In some cases there is a very fine line between healthy levels and toxic levels.



The minerals that we know pose significant health issues are arsenic, cadmium, lead, mercury and aluminum. These minerals are often referred to as 'heavy metals'. Although naturally occurring in the earth, we are increasingly subject to high levels of these elements just through daily living. Lead pipes, mercury dental fillings, industrial and agricultural runoff are just a few of the ways that humans come into excessive levels of heavy metals.

There is no way to avoid small amounts of toxic metals in our diet, even in organically grown food. After all, the earth is a big old ball of heavy metals and when we grow plants in the earth small amounts of those metals will make their way into our food.

People who have grown up in heavily polluted areas, near nuclear facilities or those that work in mining and other industries; heavy metal toxicity can cause serious health issues that often don't show up until later in life.

Off gassing from mercury fillings is another common way that people get sick from toxic metal contamination. It is wise to seek out a dentist who is qualified in the safe removal of mercury fillings. If not done properly, taking the mercury out of the mouth can actually make the problem worse.

For most people heavy metal toxicity is not an issue as the body is well designed to daily discard unrequired minerals by way of the eliminatory systems (sweat, urine, feces.) However whenever possible we should be diligent to avoid excessive exposure to these elements.

The best way to test for heavy metal contamination is through hair analysis. If excess metals are present, a detoxification program should be started. General cleansing programs help to increase liver and kidney efficiency, which in turn will up- regulate the body's ability to discard the excess minerals. For more serious metal toxicity seek medical help.

Some of the minerals that you will learn about next can become toxic if taken in excess. Supplementation of minerals, especially the micro or trace minerals is not recommended except in cases of diagnosed deficiency. If a mild mineral deficiency is suspected incorporate foods into the diet that are high in the missing mineral. Choosing a well-balanced multi-mineral supplement is preferred over supplements of individual micro-minerals that could quickly throw off the optimal balance of minerals in the body.

## Mineral Categories

In terms of nutrition, minerals are classified into those that we need a larger amount of, **Macrominerals**, and those that are only required in trace amounts, **Microminerals**.

The remainder of this lesson will focus on macro and micro minerals that are important for health.