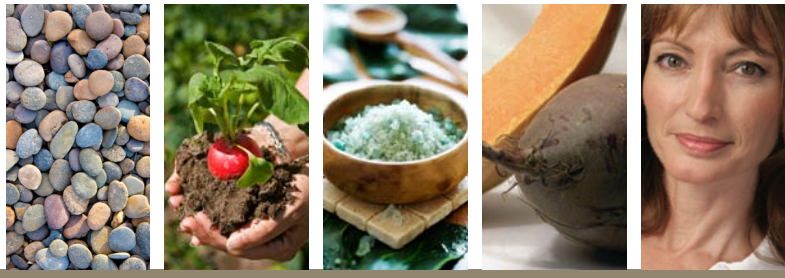
essential minerals



Minerals are essential for a wide variety of metabolic and physiological processes in the body including muscle contraction, normal heart rhythm, nerve impulse conduction, oxygen transport, oxidative phosphorylation, enzyme activation, immune function, antioxidant activity, bone health, and acid-alkaline balance of the blood.

The human body requires about 20 different minerals in order to function properly. The three major classes of minerals are macro-minerals, micro-minerals and trace elements (refer to table on page 2).

Acid-Alkaline Balance

The modern diet has changed in seven fundamental areas:

1. Glycaemic load
2. Fatty acid composition
3. Macronutrient composition
4. Micronutrient density
5. Acid-alkaline balance
6. Sodium-potassium ratio
7. Fibre content[1]

Of these seven major changes, the acid-alkaline balance is the one most frequently overlooked.

People generally consume a diet that generates metabolic acids, which leads to a reduction in the concentration of systemic bicarbonate and a fall in pH. This slight, but significant metabolic acidosis leads to greater loss of bone mineral and increased potential for fracture. This is further compounded by the fact that as we age there is a decrease in overall renal function, including a decrease in the ability to excrete metabolic acids.

Metabolic acidosis induces:

1. Hypercalciuria due to release of calcium from bone and decreased renal tubular calcium reabsorption
2. Renal phosphate depletion and hypophosphataemia
3. An increase in vitamin D and a decrease in parathyroid hormone
4. Hypocitraturia

Chronic metabolic acidosis also significantly increases glucocorticoid activity and has deleterious effects on the body, including growth retardation in children, decreased muscle and bone mass in adults, arthritis and kidney stone formation. Correction of acidosis by removing its underlying cause, improving nutrition and/or diet, and supplementation are the most important ways to prevent these adverse effects.[2]

Improving the acid-alkaline balance can be achieved with balanced mineral supplement combined with a diet high in vegetables and low in table salt, cereals, dairy and meat.

Acid forming	Beer, cola drinks, meat, fish, seafood, cereals, bread, pasta, lentils, peas, eggs, dairy, chocolate, nuts
Alkaline forming	Fruits, vegetables, whey, honey

Mineral Amino Acid Chelates

Minerals from food are naturally chelated to amino acids within the GIT for transportation across the intestinal wall. This mode of active transport prefers dipeptide structures over single amino acids. Chelating minerals to amino acids as dipeptides creates the most effective form of mineral supplement. Effective amino acid mineral chelates are created using sophisticated technology to form strong covalent bonds. Simply mixing inorganic minerals with amino acids in a liquid or dry mixture does not create a true mineral chelate, as it only forms unstable ionic and hydrogen bonds. True mineral chelates are especially useful for improving iron, zinc and manganese absorption and bioavailability.

essential minerals

CLINICAL INFORMATION

Benefits of Minerals

Minerals play an essential role in human health as evidenced by the summary in the table below.

Mineral	Function
Calcium (macro-mineral)	Essential for healthy teeth, bones and joints; muscle contraction; blood clotting; insulin activation and electrolyte balance
Chromium (trace mineral)	Component of glucose tolerance factor; regulation of glucose, cholesterol and triglycerides
Copper (micro-mineral)	Component of many enzymes; cross-linking of collagen and elastin; mitochondrial energy production; regulation of apoptosis; antioxidant
Fluoride (micro-mineral)	The cell salt Calcium Fluoride 6X is used to strengthen bones, skin and teeth
Iodine (trace mineral)	Synthesis of thyroid hormones and regulation of metabolism; essential for foetal brain development
Iron (micro-mineral)	Essential for blood and respiration transport of oxygen; energy production (ATP); immune and cognitive function
Magnesium (macro-mineral)	Involved in more than 300 essential metabolic reactions including energy production (ATP), synthesis of nucleic acids and proteins, structural roles in bone, cell membranes and chromosomes, cell signalling (cAMP), cell migration and wound-healing facilitation
Manganese (trace mineral)	Essential for mitochondrial function; component of many enzymes; formation of connective tissue and skeletal tissues, growth and reproduction; and carbohydrate metabolism
Potassium (macro-mineral)	Regulation of intracellular acid-alkaline balance; hormone secretion; membrane transport; muscle contraction; osmotic pressure; cell membranes; protein synthesis; cellular hydration; regulation of nerve and heart function
Selenium (trace mineral)	Component of glutathione peroxidase and other antioxidants; component of other enzymes including a selenoprotein responsible for thyroid hormone activation
Silicon (trace mineral)	Essential for strength and resilience of connective tissue; muscle contractions; nerve transmission
Zinc (micro-mineral)	Involved in more than 300 different enzymes; synthesis or degradation of carbohydrates, lipids, proteins and nucleic acids; structural role of several proteins; brain cell signalling; immune function; genetic expression and wound-healing

Bone Mineral Density

Numerous short-term human studies suggest that an acidic environment may lead to progressive bone loss. Diets high in acid-forming components (including several amino acids in protein foods, phosphorus and chlorine); and low in alkaline-forming components, (including fruits and vegetables, potassium, calcium, magnesium, and vitamin C), may lead to lower bone mineral density (BMD) and a higher fracture risk.

Results from a large study suggest that a good intake of fruit, vegetable, magnesium and potassium was significantly associated with greater BMD in both men and women. Unlike other studies, this particular study could find no correlation that higher protein intake leads to greater bone loss. When evaluating the protein results however, it is important to note that these subjects were elderly and on average had relatively low protein intakes.[3] In terms of the acid load there is no doubt that meat increases acidity and research has confirmed that the renal capacity to excrete ammonium (NH_4) (and as a result to excrete net acid) is modulated by the amount of protein ingested.[3]

A balance between calcium, magnesium and potassium is important for bone health however the overall acid-alkaline balance is equally important. A study of 18 postmenopausal women showed improved calcium balance, increased serum osteocalcin concentrations and decreased urinary hydroxyproline excretion with the administration of potassium bicarbonate in sufficient quantity to neutralise endogenous acid loads from normal diets. These authors concluded that this buffering protects the skeleton.[4] Another study demonstrated that a high fruit and vegetable intake is associated with a higher BMD among premenopausal women.[5] Together these findings provide a strong argument for the buffering effects of these alkaline producing foods and nutrients.

Inflammation and Arthritis

An overly acidic body is also more prone to arthritis and inflammation. A study of 76 rheumatoid arthritis patients found that an alkaline mineral supplementation significantly decreased pain and other symptoms of arthritis, reduced C-reactive protein and increased urinary pH. The patients also felt an emotional improvement and six out of 19 patients were able to reduce their medication.[6] Another study found that alkaline minerals reduced chronic lower back pain.[7]

Heavy Metal Reduction

Due to the competitive nature of minerals, heavy metal excretion may be enhanced through intensive mineralisation. For example, enhanced aluminium and lead excretion has been found to occur with calcium supplementation.[8] Zinc may

reduce cadmium absorption and accumulation, and prevent or reduce the adverse actions of cadmium.[9] Selenium supplementation protects against mercury toxicity.[10]

Sports Performance

Minerals are very important for physical performance. Minerals are involved in muscle contraction, normal heart rhythm, nerve impulse conduction, oxygen transport, oxidative phosphorylation, enzyme activation, immune functions, antioxidant activity, bone health, and acid-alkaline balance of the blood. Because many of these processes are accelerated during exercise, an adequate intake of minerals is necessary for optimal performance. Iron and calcium are the two nutrients most likely to be low in the diet, particularly in young athletes. A mineral deficiency may impair performance and in particular, correcting iron-deficiency anaemia will improve aerobic endurance and performance.

Magnesium is a component of over 300 enzymes, some involved in the regulation of muscle contraction, oxygen delivery, and protein synthesis. Several studies have shown beneficial effect of magnesium supplementation on performance. Zinc is also a component of over 300 enzymes, some involved in functions important to physical performance, such as muscle energy production and protein synthesis. Endurance athletes who adopt a diet rich in carbohydrate but low in protein and fat may not have adequate zinc intake, which over time could lead to zinc deficiency with loss of body weight, latent fatigue, and decreased endurance. Chromium is an insulin cofactor and its theorised ergogenic effect is based on the role of insulin to facilitate branch chained amino acids transport into the muscle.[11]

Metabolic Syndrome

Mild metabolic acidosis may adversely affect cardio-metabolic risk factors, possibly by increasing cortisol production. In a cross-sectional study involving 1136 young female Japanese subjects, the acidity of the diet was measured by the potential renal acid load (PRAL). More acidic dietary acid-alkaline loads were found to be associated with higher systolic and diastolic blood pressure, higher total cholesterol and LDL cholesterol levels, and increased BMI and waist circumference.[12]

Conclusion

Supplementation with a balanced multi-mineral formulation may be beneficial for many chronic conditions, not just for developing and maintaining a healthy skeleton, but also for maintaining metabolic and enzymatic processes. Mineral supplementation may also be used as a companion prescription for a multivitamin formulation or as 'acid-alkaline balancing' formulation alongside a herbal preparation.

CLINICAL INFORMATION

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