

Akujobi Anselina

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PHARMACOLOGY

200lvl

BCH204

Question :Outline the toxicity value and deficiency manifestation of the following minerals

1. Potassium
2. Calcium
3. Magnesium
4. Iron
5. Chloride

Potassium

Toxicity value

The normal level of potassium in the bloodstream is in the range of 3.5–5.0 mM, while levels of 6.3–8.0 mM (severe hyperkalemia) result in cardiac arrhythmias or even death due to cardiac arrest. Potassium is potentially quite toxic; however, potassium poisoning is usually prevented because of the vomiting reflex. The consumption of food results in mild increases in the concentration of potassium in the bloodstream, but these levels of potassium do not become toxic because of the uptake of potassium by various cells of the body as well as by the action of the kidneys transferring the potassium ions from the blood to the urine. The body's regulatory mechanisms can easily be overwhelmed, however, when potassium chloride is injected intravenously, as high doses of injected potassium can easily result in death.

deficiency manifestation

Hypokalemia is generally defined as a serum potassium level of less than 3.5 mEq/L (3.5

mmol/L). Moderate hypokalemia is a serum level of 2.5-3.0 mEq/L, and severe hypokalemia is a level of less than 2.5 mEq/L. [1] Hypokalemia is a potentially life-threatening imbalance that may be iatrogenically induced. Hypokalemia may result from inadequate potassium intake, increased potassium excretion, or a shift of potassium from the extracellular to the intracellular space. Increased excretion is the most common mechanism. Poor intake or an intracellular shift by itself is a distinctly uncommon cause, but several causes often are present simultaneously. Hypokalemia is usually diagnosed with a blood test. Your doctor may also order an electrocardiogram of your heart and an arterial blood gas test to measure pH levels in your body.

Calcium

Toxicity value

Hypercalcemia occurs when serum calcium levels are 10.5 mg/dL (also expressed as 2.63 mmol/L) or greater depending on normative laboratory values. When serum calcium levels rise above 12 mg/dL, the kidney's ability to reabsorb calcium is often limited; in turn, hypercalciuria can occur, particularly with increased calcium or vitamin D intake. Hypercalciuria is present when urinary excretion of calcium exceeds 250 mg/day in women or 275-300 mg/day in men. Often, urinary calcium excretion is expressed as the ratio of calcium to creatinine excreted in 24 hours (milligrams of calcium per milligram of creatinine). Values above 0.3 mg/mg creatinine are considered to be within the hypercalcuric range.

Deficiency manifestation

Hypocalcemia, commonly known as calcium deficiency disease, occurs when calcium levels in the blood are low. A long-term deficiency can lead to dental changes, cataracts, alterations in the brain, and osteoporosis, which causes the bones to become brittle.

Magnesium

Toxicity value

An adult body contains approximately 25 g magnesium, with 50% to 60% present in the bones and most of the rest in soft tissue. Less than 1% of total magnesium is in blood serum, and these levels are kept under tight control. Normal serum magnesium concentrations range

between 0.75 and 0.95 millimoles (mmol)/L. Hypomagnesemia is defined as a serum magnesium level less than 0.75 mmol/L. Magnesium homeostasis is largely controlled by the kidney, which typically excretes about 120 mg magnesium into the urine each day. Urinary excretion is reduced when magnesium status is low.

Deficiency manifestation

Hypomagnesemia is serum magnesium concentration $< 1.8 \text{ mg/dL}$ ($< 0.70 \text{ mmol/L}$). Causes include inadequate magnesium intake and absorption or increased excretion due to hypercalcemia or drugs such as furosemide.

Magnesium deficiency also can cause hypocalcemia, as the two are inter-related.

Iron

Toxicity value

A lethal dose of iron is in the range of 200–250 mg iron/kg body weight, meaning that a child who accidentally eats 20 or more iron tablets may die as a result of iron poisoning. Children are unfortunately likely to take large amounts of these pills because they look like candy. Within six hours of ingestion, iron toxicity can result in vomiting, diarrhea, abdominal pain, seizures, and possibly coma. In the second period of iron poisoning, the patient's symptoms appear to improve; however, this phase is followed by a terminal phase in which shock, low blood sugar levels, liver damage, convulsions, and death occur 12 to 48 hours after the fatal dose.

Toxic effects begin to occur at doses above 10–20 mg/kg of elemental iron. Ingestions of more than 50 mg/kg of elemental iron are associated with severe toxicity. In terms of blood values, iron levels above 350–500 $\mu\text{g/dL}$ are considered toxic, and levels over 1000 $\mu\text{g/dL}$ indicate severe iron poisoning.

Deficiency manifestation

Anemia occurs when you have a decreased level of hemoglobin in your red blood cells (RBCs).

Chloride

Toxicity value

A normal adult human body contains approximately 81.7 g chloride. On the basis of a total obligatory loss of chloride of approximately 530 mg/day, a dietary intake for adults of 9 mg of chloride per kg of body weight has been recommended (equivalent to slightly more than 1 g of table salt per person per day). For children up to 18 years of age, a daily dietary intake of 45 mg of chloride should be sufficient. A dose of 1 g of sodium chloride per kg of body weight was reported to have been lethal in a 9-week-old child.

Chloride toxicity has not been observed in humans except in the special case of impaired sodium chloride metabolism, e.g. in congestive heart failure. Healthy individuals can tolerate the intake of large quantities of chloride provided that there is a concomitant intake of fresh water. Little is known about the effect of prolonged intake of large amounts of chloride in the diet. As in experimental animals, hypertension associated with sodium chloride intake appears to be related to the sodium rather than the chloride ion.

Deficiency manifestation

Hypochloremia can also frequently accompany hyponatremia, a low amount of sodium in the blood.