Toxicity values and the deficiency manifestation of the following minerals:

I.Potassuim:Potassium chloride and sodium chloride were infused into the reticulorumen of male Holstein calves, approximately 6 mo of age and 260 kg, at .29, .58, 1.15, 1.73, 2.31, or 2.88 g potassium per kilogram body weight or 1.35, 2.12, or 2.16 g sodium per kilogram in equal volumes of water. Paired controls were infused with water. Calves were monitored for physiological changes for 6 h at 15, 30, or 60-min intervals. Potassium and total solids of plasma and packed cell volume were increased at potassium doses greater than .29 g of potassium per kilogram body weight within 1 h after dosing. At the higher doses of potassium, sodium content of plasma increased about 1 h after the increase in plasma potassium. Respiration rates within a potassium treatment varied with respect to time after dosing, but generally they increased, and associated variables of carbon dioxide pressure, pH, and bicarbonate in blood were decreased accordingly.

Clinical toxicity signs, including excess salivation, muscular tremors of legs, and excitability were observed with potassium doses greater than .58 g of potassium per kilogram body weight. Three of five calves given 1.73 g of potassium per kilogram, three of four calves given 2.31 g of potassium per kilogram, and one calf given 2.88 g of potassium per kilogram body weight died.

With a small number of calve, oral sodium infusions increased plasma sodium in proportion to the dose, but plasma potassium remained relatively constant. Sodium infusions of 2.12 and 2.16 g of sodium per kilogram body weight were fatal.

Deficiency manifestation:you have hypokalemia, that means you have low levels of potassium in your blood. Potassium is a mineral your body needs to work normally. It helps muscles to move, cells to get the nutrients they need, and nerves to send their signals. It’s especially important for cells in your heart. It also helps keep your blood pressure from getting too high.

Causes

There are many different reasons you could have low potassium levels. It may be because too much potassium is leaving through your digestive tract. It’s usually a symptom of another problem. Most commonly, you get hypokalemia when:

You vomit a lot

You have diarrhea

Your kidneys or adrenal glands don’t work well

You take medication that makes you pee (water pills or diuretics)

It’s possible, but rare, to get hypokalemia from having too little potassium in your diet. Other things sometimes cause it, too, like:

Drinking too much alcohol

Sweating a lot

Folic acid deficiency

Certain antibiotics

Diabetic ketoacidosis (high levels of acids called ketones in your blood)

Laxatives taken over a long period of time

Certain types of tobacco

Some asthma medications

Low magnesium

Several syndromes can be associated with low potassium, such as:

Cushing's syndrome

Gitelman syndrome

Liddle syndrome

Bartter syndrome

Fanconi syndrome

Women tend to get hypokalemia more often than men.

CONTINUE READING BELOW

Symptoms

If your problem is temporary, or you’re only slightly hypokalemic, you might not feel any symptoms. Once your potassium levels fall below a certain level, you might experience:

Weakness

Fatigue

Muscle cramps or twitching

Constipation

Arrhythmia (abnormal heart rhythms)

Hypokalemia can affect your kidneys. You may have to go to the bathroom more often. You may also feel thirsty.

You may notice muscle problems during exercise. In severe cases, muscle weakness can lead to paralysis and possibly respiratory failure.

Diagnosis

You will need a blood test for your doctor to find out if you have hypokalemia. He will ask you about your health history. He'll want to know if you've had any illness that involved vomiting or diarrhea. He'll ask about any conditions you might have that could be causing it.

You may take a urine test so your doctor can find out if you're losing potassium when you pee.

Since low potassium sometimes can affect your blood pressure, your doctor will check that, too. He also may want to do an electrocardiogram (EKG) if he thinks you may have arrhythmia. This is one of the more serious side effects, and might change the way your doctor chooses to treat the problem.

CONTINUE READING BELOW

Treatment

You can get more potassium by taking supplements. Most of these you can take by mouth. In some cases it's necessary to get your potassium injected by IV. For example:

If your potassium level is dangerously low

If taking supplements don't raise your potassium levels

If your low potassium levels cause abnormal heart rhythms

When your hypokalemia is a result of another medical condition, your doctor will help you treat that. If you have low potassium because of diuretics, he may take you off them. Sometimes that makes the condition go away.

Always check with your doctor before you stop any medicine. Also, ask him before you take any potassium supplements. This might cause too much potassium to build up in your system, which could lead to hyperkalemia.

B.Calcuim:The influence of calcium content in diet on cumulation and toxicity of cadmium in the organism.

Brzóska MM1, Moniuszko-Jakoniuk J.

Author information

Abstract

Voluminous literature data show that great interdependence exists between the nutrition status of the organism and the degree of accumulation and toxicity of heavy metals. In this work, the connection between dietary calcium and cadmium toxicity is discussed from the toxicological point of view. Cadmium is one of the most dangerous occupational and environmental poisons. The intake of diet containing an inappropriate amount of calcium causes increased absorption of cadmium from the gastrointestinal tract and increased accumulation of this metal in the organism, finally leading to enhancement of cadmium toxic action. The large intake of calcium protects against absorption, cumulation and toxicity of this heavy metal. Interactions between calcium and cadmium may take place at different stages of their metabolism (absorption, distribution in the organism, elimination) and cadmium may interfere with the biological functions of Ca2+ ions.

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.

Complications of hypocalcemia can be life-threatening, and if the condition goes untreated, it could eventually lead to death.

A calcium deficiency may have no early symptoms. To avoid complications, a person should seek prompt diagnosis and treatment if they experience any of the symptoms listed below.

In this article, we also describe the prevalence of calcium deficiency disease, how to prevent it, and how it is treated.

What are the symptoms?

The symptoms described below may become worse as the disease progresses.

1. Muscle problems

Calcium deficiency can lead to extreme tiredness and fatigue.

Muscle aches, cramps, and spasms are the earliest signs of a calcium deficiency. People tend to feel pain in the thighs and arms, particularly the underarms, when walking and otherwise moving.

A calcium deficiency can also cause numbness and tingling in the hands, arms, feet, legs, and around the mouth.

These sensations may indicate a more severe deficiency.

These symptoms can come and go, but they do not disappear with activity, and a person may have to wait them out.

2. Extreme fatigue

Low levels of calcium can cause insomnia or sleepiness.

People tend to experience:

extreme fatigue

lethargy

an overall feeling of sluggishness

lack of energy

Fatigue associated with calcium deficiency can also cause lightheadedness, dizziness, and brain fog, which involves lack of focus, forgetfulness, and confusion.

3. Nail and skin symptoms

Chronic calcium deficiency can affect the skin and nails.

The skin may become dry and itchy, and researchers have linked hypocalcemia to eczema and psoriasis. Eczema is a general term for skin inflammation. Symptoms include itchiness, redness, and skin blisters. Eczema is highly treatable, while psoriasis can be managed, but there is no cure.

A calcium deficiency may lead to dry, broken, and brittle nails. It can also contribute to alopecia, a condition that causes hair to fall out in round patches.

4. Osteopenia and osteoporosis

Calcium deficiency can lead to osteopenia and osteoporosis.

Osteopenia reduces the mineral density of bones, and it can lead to osteoporosis. Osteoporosis makes bones thinner and more susceptible to fractures. It can cause pain, issues with posture, and eventual disability.

While osteopenia is less severe than osteoporosis, both cause diminished bone density and increased risk of breaks and fractures.

The bones store calcium well, but they require high levels to stay strong. When overall levels of calcium are low, the body can divert it from the bones, making them brittle and prone to injury.

It takes years for bones to lose their density, and a calcium deficiency may take as long to cause serious problems.

5. Painful premenstrual syndrome (PMS)

Low levels of calcium may lead to tooth decay.

Low calcium levels have been linked to severe PMS.

Participants in one 2017 study reported improved mood and reduced rates of fluid retention after taking 500 milligrams (mg) of calcium daily for 2 months.

In 2019, authors of a systematic review concluded that low levels of vitamin D and calcium during the second half of the menstrual cycle might contribute to symptoms of PMS. The team proposed using supplements to help relieve symptoms.

6. Dental Problems

When the body lacks calcium, it pulls it from sources such as the teeth. This can lead to dental problems, including weak roots, irritated gums, brittle teeth, and tooth decay.

Also, calcium deficiency in infants can delay tooth formation.

7. Depression

Calcium deficiency has been linked to mood disorders, including depression, though evidence is lacking.

Anyone who suspects that a calcium deficiency is contributing to depressive symptoms should ask a doctor to check their levels. Calcium supplements could help to manage these symptoms.

When to see a doctor

Anyone experiencing symptoms of a calcium deficiency should speak with a doctor. They will order tests and check the levels of calcium in the blood.

The normal range for adults is 8.8–10.4 milligrams per deciliter (mg/dL). Children require more calcium than adults, and any level lower than 8.8 mg/dL constitutes a deficiency.

How common is calcium deficiency disease?

While incidence and prevalence are not yet firmly established, the following information can give an impression of who is at risk.

Calcium deficiency in the United States

According to a 2013 report published in the Journal of the American College of Nutrition, the following populations are most likely to have a calcium deficiency:

older adults

teenagers

minorities

people who are overweight

Calcium deficiency worldwide

In 2013, authors at British universities reported that calcium deficiency is common in chronically ill people.

According to global estimates published in 2015, 3.5 billion people are at risk for calcium deficiency.

Authors at Pakistani universities surveyed 252 female participants. While 41 percent were calcium and vitamin D deficient, 78 percent reported symptoms consistent with these

deficiencies, including pain in the back, legs, and joints.

Results suggest that many women have low levels of these nutrients but may be unaware.

Complications

Calcium deficiency has been linked to:

seizures

dental problems

depression

various skin conditions

chronic joint and muscle pain

fractures

disability

A study that included 1,038 people admitted for critical care at the Royal Liverpool University Hospital found that 55.2 percent were hypocalcemic and that 6.2 percent of these people had a severe deficiency.

Treatment and prevention

Calcium-rich foods can help reduce the likelihood of deficiency.

The safest and easiest way to manage and prevent a calcium deficiency is to add more calcium to the diet.

Some calcium-rich foods include:

dairy products, such as milk, cheese, and yogurt

beans

figs

broccoli

tofu

soy milk

spinach

fortified cereals

nuts and seeds, including almonds and sesame seeds

The daily recommended amount of calcium in the diet is 1,000 mg for people aged 19–50, while children, teens, and older adults tend to require more.

It is not a good idea to start taking calcium supplements without first consulting a doctor. Too much calcium increases the risk for cardiovascular disease, kidney stones, and other serious health problems.

When a deficiency is severe, or when supplements and dietary adjustments are not achieving sufficient results, a doctor may prescribe calcium injections.

Takeaway

Calcium deficiency can occur for a number of reasons and is most easily prevented through dietary changes.

Most people with calcium deficiencies who take supplements or receive injections notice improved symptoms within a few weeks.

People with severe deficiencies may be monitored to prevent complications.

C.Magnessuim: The toxicity of magnesium sulfate (MgSO(4)), and the influence of calcium (Ca), were assessed in very soft freshwater (natural Magela Creek water [NMCW]) using six freshwater species (Chlorella sp., Lemna aequinoctialis, Amerianna cumingi, Moinodaphnia

macleayi, Hydra viridissima, and Mogurnda mogurnda). The study involved five stages: toxicity of MgSO(4) in NMCW, determination of the toxic ion, influence of Ca on Mg toxicity, toxicity of MgSO(4) at an Mg:Ca mass ratio of 9:1, and derivation of water quality guideline values for Mg. The toxicity of MgSO(4) was higher than previously reported, with chronic median inhibition concentration (IC50)/acute median lethal concentration (LC50) values ranging from 4 to 1,215 mg/L, as Mg. Experiments exposing the 3 most sensitive species (L. aequinoctialis, H. viridissima, and A. cumingi) to Na(2)SO(4) and MgCl(2) confirmed that Mg was the toxic ion. Additionally, Ca was shown to have an ameliorative effect on Mg toxicity. For L. aequinoctialis and H. viridissima, Mg toxicity at the IC50 concentration was eliminated at Mg:Ca (mass) ratios of < or =10:1 and < or =9:1, respectively. For A. cumingi, a 10 to 30% effect persisted at the IC50 concentration at Mg:Ca ratios <9:1. The toxicity of MgSO(4) in NMCW at a constant Mg:Ca ratio of 9:1 was lower than at background Ca, with chronic IC50/acute LC50 values from 96 to 4,054 mg/L, as Mg. Water quality guideline values for Mg (to protect 99% of species) at Mg:Ca mass ratios of >9:1 and < or =9:1 were 0.8 and 2.5 mg/L, respectively. Magnesium can be toxic at concentrations approaching natural background levels, but toxicity is dependent on Ca concentrations, with exposure in very low ionic concentration, Ca-deficient waters posing the greatest risk to aquatic life.

Magnesium deficiency is an electrolyte disturbance in which there is a low level of magnesium in the body. It can result in multiple symptoms.[3] Symptoms include tremor, poor coordination, muscle spasms, loss of appetite, personality changes, and nystagmus.[1][2] Complications may include seizures or cardiac arrest such as from torsade de pointes.[1] Those with low magnesium often have low potassium.

D.Chloride: Toxicity value:HUMAN TOXICITY DATA

2.1. Acute Lethality

For humans, a 5-min lethal concentration in 10% of subjects (LC10) of 500 ppm (NTIS 1996) and a possible 30-min lethal exposure of 872 ppm have been reported (Perry et al. 1995). Both of those secondary sources cited data from Prentiss (1937) as well as data from other early sources.

Although accidental releases have resulted in deaths (e.g., Jones et al. 1986), no studies were located in which acute lethal exposure concentrations were measured. Probit analysis of available information on the lethality of chlorine to animals and humans was used by Withers and Lees (1985b) to estimate a concentration lethal to 50% of the population (LC50). Their model incorporates the effects of physical activity, inhalation rate, the effectiveness of medical treatment, and the lethal toxic load function. The estimated 30-min LC50 at a standard level of activity (inhalation rate of 12 liters [L]/min) for the regular, vulnerable, and average (regular plus vulnerable) populations, as described by the authors, were 250,100, and 210 ppm, respectively. The LC10 for the three populations were 125, 50, and 80 ppm, respectively.

2.2. Nonlethal Toxicity

Exposures at 30 ppm and 40–60 ppm have been reported to cause intense coughing and serious damage, respectively (ILO 1998), but no documentation of those values was given.

Deficiency:Hypochloremia is an electrolyte imbalance that occurs when there's a low amount of chloride in your body.

Chloride is an electrolyte. It functions with other electrolytes in your system, such as sodium and potassium, to regulate the amount of fluid and the pH balance in your body. Chloride is most commonly consumed as table salt (sodium chloride).

E.Iron: toxicity value:Iron toxicity from intentional or accidental ingestion is a common poisoning. The acute ingestion of iron is especially hazardous to children. Life-threatening toxicity is associated with pediatric ingestion of potent adult preparations, such as prenatal vitamins. Serious iron ingestion in adults is usually associated with suicide attempts.[1][2]

Accidental ingestions are more common in children less than 6 years. In addition, iron toxicity may also develop after multiple blood transfusions for a chronic disorder like thalassemia, sickle cell, and hematological cancers.

Etiology

Ingestion of less than 20 mg/kg of elemental iron is non-toxic. Ingestion of 20 mg/kg to 60 mg/kg results in moderate symptoms. Ingestion of more than 60 mg/kg can result in severe toxicity and lead to severe morbidity and mortality. The amount of elemental iron ingested is different depending on the formulations of iron salts. The most common iron formulations are 325 mg ferrous sulfate tablets, which contains 20% (or 65 mg) of elemental iron per tablet; 300 mg ferrous gluconate tablets, which contain 12% (or 36 mg) of elemental iron per tablet; and 100 mg ferrous fumarate tablets, which contain 33% (or 33 mg) of elemental iron per tablet. Prenatal vitamins may contain 60 to 90 mg of elemental iron per tablet. Children's vitamins vary from 5 to 19 mg of elemental iron per tablet.[1]

Epidemiology

In 2015, the Annual Report of the American Association of Poison Control Centers (AAPCC) National Poison Data System reported 4072 single exposures to iron or iron salts. Out of these,

3211 cases were unintentional ingestion. Furthermore, 2036 of reported cases occurred in children 5 years old or younger, and 1161 cases were treated in a healthcare facility. There was one death.[3]

Pathophysiology

Iron toxicity is classified as corrosive or cellular. Ingested iron can cause direct caustic injury to the gastrointestinal mucosa, resulting in nausea, vomiting, abdominal pain, and diarrhea. Significant fluid and blood loss can lead to hypovolemia. Hemorrhagic necrosis of gastrointestinal mucosa can lead to hematemesis, perforation, and peritonitis. At the cellular level, iron impairs cellular metabolism in the heart, liver, and central nervous system. Free iron enters cells and concentrates in the mitochondria. This disrupts oxidative phosphorylation, catalyzes lipid peroxidation, forms free radicals, and ultimately leads to cell death.[4]

When cellular injury occurs, metabolic acidosis is common.

Toxicokinetics

Serum iron level peaks at 2 to 4 hours post-ingestion, but serum concentrations of enteric-coated or sustained-release formulations are erratic and warrant serial levels. Approximately 10% of ingested iron is absorbed from the intestine and is subsequently bound to transferrin. Normal serum iron levels range from 50 to 150 micrograms/dL, and total iron-binding capacity (TIBC) ranges from 300 to 400 micrograms/dL. When iron levels rise after significant ingestion, transferrin becomes saturated. Excess iron will circulate in the blood as free iron, which is directly toxic to target organs

Deficiency: Anaemia is iron deficiency.