GREEN GRACE IGBOGI

18/MHS07/021

PHARMACOLOGY

BCH 204 ASSIGNMENT

QUESTION

Outline the toxicity values and deficiency manifestations of the following minerals

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

Toxicity value

Potassium clearly has its potential for risks including life-threatening hyperkalaemia and cardiac arrest. It is very concerning that the slow-release preparation is available in bottles of 100 without prescription. Aggressive decontamination and haemodialysis are indicated in large overdoses.

**Toxic Mechanism:**

Like all metal ingestions they are a direct GI irritant. Once intracellular potassium interferes with electrical conduction in both nerves and muscle resulting in cardiac arrest.

**Toxicokinetics:**

* Rapidly absorbed in the small bowel
* Distributed to the intracellular compartment
* Excreted in the urine (90-95%), faeces and sweat. Once absorption exceeds redistribution and excretion, hyperkalaemia ensues.

**Resuscitation:**

* **Urgent management of hyperkalaemia:**
	+ Calcium chloride 10 ml 10% IV (0.15 ml/kg in children)
	+ Nebulised salbutamol 10 -20mg (2.5mg in children <5 years, 5mg in children >5 years)
	+ Dextrose 50ml 50% and insulin 10 IU IV (10 ml/kg 10% dextrose and insulin 0.1 IU/kg in children)
	+ Sodium bicarbonate 50 – 100 mmol slow IV (1 mmol/kg in children)

## Potassium deficiency Manifestations

Certain conditions can cause potassium deficiencies, or [hypokalemia](https://www.healthline.com/health/hypokalemia). These include:

* [kidney disease](https://www.healthline.com/health/kidney-disease)
* overuse of [diuretics](https://www.healthline.com/health/diuretics)
* [excessive sweating](https://www.healthline.com/health/hyperhidrosis), [diarrhea](https://www.healthline.com/symptom/diarrhea), and [vomiting](https://www.healthline.com/symptom/vomiting)
* [magnesium deficiency](https://www.healthline.com/health/hypomagnesemia)
* use of antibiotics, such as carbenicillin and [penicillin](https://www.healthline.com/health/penicillin-v-oral-tablet)

The symptoms of hypokalemia are different depending on how severe your deficiency is.

A temporary decrease in potassium may not cause any symptoms. For example, if you sweat a lot from a hard workout, your potassium levels may normalize after eating a meal or drinking electrolytes before any damage is done.

However, severe deficiencies can be life-threatening. Signs of a potassium deficiency include:

* extreme fatigue
* muscle spasms, weakness, or cramping
* irregular heartbeat
* constipation, nausea, or vomiting
	1. Calcium

The daily upper limits for calcium are listed below in milligrams (mg).

| Life Stage | Upper Limit |
| --- | --- |
| Birth to 6 months | 1,000 mg |
| Infants 7–12 months | 1,500 mg |
| Children 1–8 years | 2,500 mg |
| Children 9–18 years | 3,000 mg |
| Adults 19–50 years | 2,500 mg |
| Adults 51 years and older | 2,000 mg |
| Pregnant and breastfeeding teens | 3,000 mg |
| Pregnant and breastfeeding adults | 2,500 mg |

Deficiency Manifestation of Calcium

 Calcium deficiency can include:

* Numbness.
* Tingling Fingers.
* Muscle cramps.
* Lethargy.
* Poor appetite.
* Weak or brittle fingernails.
* Difficulty swallowing.
* Fainting.
	1. Magnesium

Toxicity value

| Table 1: Recommended Dietary Allowances (RDAs) for Magnesium. Anything above this can cause toxicity of magnesium.  |
| --- |
| Age | Male | Female | Pregnancy | Lactation |
| Birth to 6 months | 30 mg\* | 30 mg\* |  |  |
| 7–12 months | 75 mg\* | 75 mg\* |  |  |
| 1–3 years | 80 mg | 80 mg |  |  |
| 4–8 years | 130 mg | 130 mg |  |  |
| 9–13 years | 240 mg | 240 mg |  |  |
| 14–18 years | 410 mg | 360 mg | 400 mg | 360 mg |
| 19–30 years | 400 mg | 310 mg | 350 mg | 310 mg |
| 31–50 years | 420 mg | 320 mg | 360 mg | 320 mg |
| 51+ years | 420 mg | 320 mg |  |  |

Deficiency Manifestation of Magnesium

Symptomatic magnesium deficiency due to low dietary intake in otherwise-healthy people is uncommon because the kidneys limit urinary excretion of this mineral. However, habitually low intakes or excessive losses of magnesium due to certain health conditions, chronic alcoholism, and/or the use of certain medications can lead to magnesium deficiency.

Early signs of magnesium deficiency include loss of appetite, nausea, vomiting, fatigue, and weakness. As magnesium deficiency worsens, numbness, tingling, muscle contractions and cramps, seizures, personality changes, abnormal heart rhythms, and coronary spasms can occur. Severe magnesium deficiency can result in hypocalcemia or hypokalemia (low serum calcium or potassium levels, respectively) because mineral homeostasis is disrupted.

* 1. Chloride

Chloride toxicity has not been observed in humans except in the special case of impaired sodium chloride metabolism, e.g. in congestive heart failure (13). Healthy individuals can tolerate the intake of large quantities of chloride provided that there is a concomitant intake of fresh water. If Chloride is higher than the values below then where would be toxicity.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |
| --- |
| Table 1 Summary of NaCl, Sodium and Chloride Guidelines |
|   | Na+ (mg/L) | Cl- (mg/L) | NaCl (mg/L) | Comments |
| Human health | 20 | 250 |   | EPA drinking water quality standards |
| Wildlife |   | 600 | 1000 | Nagpal et al (2003)[1](https://www.des.nh.gov/organization/divisions/water/wmb/was/salt-reduction-initiative/impacts.htm#ftn1) |
| Aquatic organisms |   | 860 – 1-hour average230 – 4-day average |   | NHDES water quality standard |
| Terrestrial and emergent plants |   | 300 | 800 | Groundwater source[2](https://www.des.nh.gov/organization/divisions/water/wmb/was/salt-reduction-initiative/impacts.htm#ftn2) |
| Aquatic plants |   | 200 – 36,400 |   | USEPA, 1988[3](https://www.des.nh.gov/organization/divisions/water/wmb/was/salt-reduction-initiative/impacts.htm#ftn3) |

 |
|  |

Deficiency Manifestation of Chloride incclude:

* excessive fatigue.
* muscle weakness.
* breathing problems.
* frequent vomiting.
* prolonged diarrhea.
* excessive thirst.
* high blood pressure.
	1. Iron

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 μg/dL are considered toxic, and levels over 1000 μg/dL indicate severe iron poisoning.

Deficiency Manifestation of Iron

* Liver necrosis
* Cardiogenic shock
* Myocardial dysfunction
* Coma
* Seizures
* Coagulopathy
* Esophagitis
* Anemia
* ARDS
* Stricture formation of the intestine
* Gastric perforation