

# Companion of Top 10 micronutrients from LPI

(listed below are Health Issues arising from Deficiencies)

## Vitamin B6

### Deficiency - Potential Health Problems:

**Microcytic Anemia:** A type of anemia characterized by smaller-than-normal red blood cells, leading to fatigue, weakness, shortness of breath, and pale skin. [Microcytic Hypochromic Anemia - StatPearls - NCBI Bookshelf](#)

**Skin Problems:** B6 deficiency can manifest as dermatitis (skin inflammation), cheilosis (cracks at the corners of the mouth), and glossitis (inflamed tongue). [Vitamin B6 - Health Professional Fact Sheet - NIH Office of Dietary Supplements](#)

**Neurological Issues:** In severe cases, B6 deficiency can lead to seizures, peripheral neuropathy (numbness and tingling in the hands and feet), and cognitive impairment. [Nutritional Deficiencies as a Seizure Trigger | Epilepsy Foundation](#)

**Weakened Immune Function:** B6 is essential for a healthy immune system. Deficiency can increase susceptibility to infections. [Vitamin B6 - Health Professional Fact Sheet - NIH Office of Dietary Supplements](#)

**Mood Disorders:** Depression and confusion have been associated with B6 deficiency. [Vitamin B6 level is associated with symptoms of depression - PubMed](#)

### Specific Populations at Risk:

**Older Adults:** Reduced dietary intake and impaired absorption can increase the risk of deficiency in this population. [Vitamin B6 Deficiency - StatPearls - NCBI Bookshelf](#)

**People with Certain Medical Conditions:** Kidney disease, autoimmune disorders, and certain gastrointestinal conditions can impair B6 absorption or increase its excretion. [Signs and Symptoms of Vitamin B6 Deficiency - Health](#)

**Pregnant and Breastfeeding Women:** Increased B6 requirements during pregnancy and lactation can put these women at risk if their intake is <sup>2</sup>inadequate. [Effect of energy restriction and exercise on vitamin B-6 status of women during lactation](#)

**People taking Certain Medications:** Some medications, like isoniazid (used to treat tuberculosis), can interfere with B6 metabolism.

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## Vitamin B12

### Deficiency Symptoms/Health Problems

**Megaloblastic Anemia:** A type of anemia characterized by larger-than-normal red blood cells, leading to fatigue, weakness, shortness of breath, and pale skin. [Vitamin B12 Deficiency Anemia - Johns Hopkins Medicine](#)

**Neurological Symptoms:** Nerve damage can cause numbness and tingling in the hands and feet, difficulty walking, memory loss, and even dementia in severe cases. [Vitamin B12 Deficiency: Symptoms, Causes & Treatment - Cleveland Clinic](#)

**Other Symptoms:** Glossitis (inflammation of the tongue), mouth ulcers, loss of appetite and weight loss, irritability or mood changes, depression, vision problems [Vitamin B12 Deficiency: Causes, Symptoms, and Treatment - WebMD](#)

### Populations at Risk

**Older Adults:** Reduced dietary intake and impaired absorption can increase the risk of deficiency in this population. [Vitamin B12–Deficiency Anemia | NHLBI, NIH](#)

**People with Certain Medical Conditions:** Conditions affecting the stomach or small intestine, such as atrophic gastritis, pernicious anemia, Crohn's disease, celiac disease, and gastric bypass surgery; other conditions like

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diabetes, HIV/AIDS, and certain cancers [Vitamin B12 Deficiency: Causes, Symptoms, and Treatment - WebMD](#)

**People taking Certain Medications:** Some medications can interfere with B12 absorption or utilization, including proton pump inhibitors (PPIs), metformin, certain antibiotics, and colchicine [Vitamin B12 Deficiency: Symptoms, Causes & Treatment - Cleveland Clinic](#)

**Vegans and Vegetarians:** Since B12 is primarily found in animal products, people following these diets are at a higher risk unless they take supplements or consume fortified foods. [Vitamin B12–Deficiency Anemia | NHLBI, NIH](#)

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## Vitamin C

### Deficiency Symptoms/Health Problems

**Scurvy:** A condition characterized by fatigue, weakness, bleeding gums, easy bruising, slow wound healing, and joint pain.

<https://my.clevelandclinic.org/health/diseases/24318-scurvy>

**Impaired Immune Function:** Vitamin C deficiency can weaken the immune system, making individuals more susceptible to infections. [Vitamin C and Immune Function](#)

**Skin Problems:** Dry skin, rough skin, and corkscrew-shaped hair. [Vitamin C Deficiency](#)

**Anemia:** Vitamin C deficiency can contribute to iron-deficiency anemia. [Vitamin C Deficiency Anemia](#)

### Populations at Risk

**People with limited access to fresh fruits and vegetables:** Those who consume a diet low in fruits and vegetables, especially citrus fruits, berries, and leafy greens, are at risk.

**Smokers:** Smoking increases the need for Vitamin C, and smokers may require additional intake to meet their needs. [Vitamin C - Health Professional Fact Sheet](#)

**People with certain medical conditions:** Certain conditions can affect vitamin C absorption or increase its excretion, such as malabsorption disorders, kidney disease, and cancer. [Vitamin C](#)

**Infants fed evaporated or boiled milk:** These milk products lose Vitamin C during processing and may require supplementation. [Vitamin C](#)

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## Vitamin D

### Deficiency Symptoms/Health Problems

**Rickets in children:** A condition characterized by soft and weak bones, leading to skeletal deformities, delayed growth, and muscle weakness. [Rickets - Mayo Clinic](#)

**Osteomalacia in adults:** Softening of the bones, causing bone pain, muscle weakness, and increased risk of fractures. [Osteomalacia - Mayo Clinic](#)

**Increased risk of osteoporosis:** Vitamin D deficiency can contribute to decreased bone density and increased risk of fractures, especially in older adults. [Vitamin D and Your Health: Breaking Old Rules, Raising New Hopes](#)

**Impaired immune function:** Vitamin D plays a role in immune system regulation, and deficiency can increase susceptibility to infections. [Role of Vitamin D in the Immune System](#)

**Increased risk of certain chronic diseases:** Research suggests a link between Vitamin D deficiency and an increased risk of various conditions, including heart disease, cancer, diabetes, and autoimmune diseases. [Vitamin D and Health](#)

### Populations at Risk

**People with limited sun exposure:** Individuals who spend most of their time indoors or live in areas with limited sunlight exposure are at risk, as the body primarily synthesizes Vitamin D from sunlight. [Vitamin D](#)

**People with darker skin pigmentation:** Darker skin pigmentation reduces the skin's ability to produce Vitamin D from sunlight. [Vitamin D](#)

**Older adults:** The skin's ability to synthesize Vitamin D decreases with age, and older adults may also have reduced dietary intake. [Vitamin D](#)

**People with certain medical conditions:** Conditions affecting fat absorption, such as Crohn's disease and celiac disease, can impair Vitamin D absorption. [Vitamin D](#)

**Breastfed infants:** Breast milk may not provide enough Vitamin D, and supplementation may be necessary. [Vitamin D](#)

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## Vitamin E

### Deficiency Symptoms/Health Problems

**Neuromuscular Problems:** Vitamin E deficiency can lead to muscle weakness, loss of coordination, and difficulty walking. It can also cause nerve damage (peripheral neuropathy), leading to numbness and tingling in the hands and feet. [Vitamin E Deficiency - StatPearls - NCBI Bookshelf](#)

**Vision Problems:** Retinopathy (damage to the retina) can occur due to Vitamin E deficiency, potentially leading to vision impairment. [Vitamin E](#)

**Weakened Immune System:** Vitamin E plays a role in immune function, and deficiency can increase susceptibility to infections. [Vitamin E](#)

### Populations at Risk

- **People with Fat Malabsorption Disorders:** Conditions such as Crohn's disease, cystic fibrosis, and certain liver diseases can impair the absorption of fat-soluble vitamins like Vitamin E, increasing the risk of deficiency. [Vitamin E](#)
  - **Premature Infants:** Premature babies may have low Vitamin E levels at birth and may require supplementation. [Vitamin E](#)
  - **People with Rare Genetic Disorders:** Certain genetic disorders affecting Vitamin E metabolism or transport can lead to deficiency even with adequate intake. [Vitamin E Deficiency - StatPearls - NCBI Bookshelf](#)
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# Vitamin K

## Deficiency Symptoms/Health Problems

- **Easy Bruising and Bleeding:** Vitamin K deficiency can lead to easy bruising, bleeding from wounds or gums, nosebleeds, and heavy menstrual bleeding.

[Vitamin K Deficiency - StatPearls - NCBI Bookshelf](#)

- **Hemorrhagic Disease of the Newborn:** In rare cases, severe Vitamin K deficiency in newborns can cause bleeding within the brain or other organs, potentially leading to serious complications.

[1. Vitamin K Deficiency - MSD Manuals](#)

- **Poor Bone Health:** Vitamin K is involved in bone mineralization, and deficiency can contribute to decreased bone density and increased risk of fractures. [1. Vitamin K Deficiency - StatPearls - NCBI Bookshelf](#)

## Populations at Risk

- **Newborns:** Newborns have low Vitamin K levels at birth and are at risk of hemorrhagic disease of the newborn unless they receive a Vitamin K injection shortly after birth. [Vitamin K and newborn babies - Better Health Channel](#)
- **People with Fat Malabsorption Disorders:** Conditions such as celiac disease, cystic fibrosis, and certain liver diseases can impair the absorption of fat-soluble vitamins like Vitamin K. [Vitamin K Deficiency - StatPearls - NCBI Bookshelf](#)
- **People taking Certain Medications:** Some medications, like long-term antibiotic use or blood thinners, can interfere with Vitamin K production or function. [Vitamin K Deficiency - StatPearls - NCBI Bookshelf](#)
- **Older Adults:** Reduced dietary intake, decreased gut bacteria, and medications can increase the risk of deficiency in this population. [Vitamin K Deficiency - StatPearls - NCBI Bookshelf](#)

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# Calcium

## Deficiency Symptoms/Health Problems

- **Hypocalcemia:** This condition occurs when blood calcium levels are abnormally low. Symptoms can include muscle cramps, numbness and tingling in the hands and feet, seizures, confusion, and irregular heartbeat.

[Hypocalcemia - StatPearls - NCBI Bookshelf](#)

- **Osteoporosis:** Long-term calcium deficiency can contribute to decreased bone density and increased risk of fractures.

[Calcium - Health Professional Fact Sheet - NIH Office of Dietary Supplements](#)

- **Rickets in children:** Calcium deficiency can cause rickets, a condition where bones become soft and weak, leading to skeletal deformities and delayed growth. [Rickets and osteomalacia - NHS](#)
- **Osteomalacia in adults:** Similar to rickets, osteomalacia causes softening of the bones, leading to bone pain, muscle weakness, and increased risk of fractures. [Rickets and osteomalacia | nidirect](#)

## Populations at Risk

- **Postmenopausal women:** Hormonal changes during menopause can increase the risk of bone loss and calcium deficiency.
- [Calcium - Health Professional Fact Sheet - NIH Office of Dietary Supplements](#)
- **People with lactose intolerance or dairy allergies:** These individuals may have difficulty consuming adequate calcium from dairy products, which are a major source of dietary calcium.
- **People with certain medical conditions:** Conditions that affect calcium absorption or increase its excretion, such as Crohn's disease, celiac disease, kidney disease, and hyperparathyroidism, can increase the risk of deficiency.

[Bones - Crohn's & Colitis UK](#)

- **Vegans and vegetarians:** Plant-based diets may be lower in calcium if not carefully planned to include calcium-rich sources like leafy greens, fortified plant milk, and tofu.

[Calcium intake in vegan and vegetarian diets: A systematic review and Meta-analysis](#)

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## Magnesium

### Deficiency Symptoms/Health Problems

- **Muscle cramps and tremors:** Magnesium deficiency can lead to involuntary muscle contractions, spasms, and tremors.
- [8 magnesium deficiency symptoms \(and 9 high magnesium foods\) | University Health Center - University of Nebraska–Lincoln](#)



- **Fatigue and Weakness:** Inadequate magnesium levels can cause fatigue, weakness, and decreased energy levels.
- [Magnesium deficiency - symptoms, causes, treatment & prevention - Healthdirect](#)
- **Nausea and Vomiting:** Magnesium deficiency can also affect the digestive system, causing nausea and vomiting.

[8 magnesium deficiency symptoms \(and 9 high magnesium foods\) | University Health Center - University of Nebraska–Lincoln](#)

- **Loss of Appetite:** Another gastrointestinal symptom of magnesium deficiency is a decreased appetite.

[Magnesium deficiency - symptoms, causes, treatment & prevention - Healthdirect](#)

- **Numbness and Tingling:** In more severe cases, deficiency can cause numbness and tingling sensations, particularly in the extremities.
- [1. Hypomagnesemia: What It Is, Causes, Symptoms & Treatment - Cleveland Clinic](#)
- **Abnormal Heart Rhythms:** Magnesium plays a role in regulating heart rhythm, and deficiency can lead to irregular heartbeats.
- [Does Magnesium Help With Heart Palpitations? - Cleveland Clinic Health Essentials](#)

## Populations at Risk

- **Older Adults:** Age-related changes in the digestive system and decreased dietary intake can increase the risk of magnesium deficiency in older individuals.
- [Magnesium - Health Professional Fact Sheet - NIH Office of Dietary Supplements](#)
- **People with Gastrointestinal Disorders:** Conditions like Crohn's disease, celiac disease, and chronic diarrhea can impair magnesium absorption.

[Magnesium - Health Professional Fact Sheet - NIH Office of Dietary Supplements](#)

- **People with Diabetes:** People with diabetes may have increased magnesium loss through urine, increasing their risk of deficiency.
- [Hypomagnesemia in Type 2 Diabetes: A Vicious Circle?](#)
- **People with Alcohol Dependence:** Excessive alcohol intake can interfere with magnesium absorption and increase its excretion.
- [Lower Serum Magnesium Concentrations are associated With Specific Heavy Drinking Markers, Pro-Inflammatory Response and Early-Stage Alcohol-associated Liver Injury - Oxford Academic](#)



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## Potassium

### Deficiency Symptoms/Health Problems

- **Muscle weakness and cramps:** Potassium is essential for muscle function, and deficiency can lead to muscle weakness, cramps, and even paralysis in severe cases. [Hypokalemia - StatPearls - NCBI Bookshelf](#)
- **Fatigue and Weakness:** Low potassium levels can disrupt the body's electrolyte balance, leading to feelings of tiredness and overall weakness.

[Low Potassium Level Causes \(Hypokalemia\) - Cleveland Clinic](#)

- **Constipation:** Potassium deficiency can slow down the digestive system, leading to constipation.

[Low Potassium Level Causes \(Hypokalemia\) - Cleveland Clinic](#)

- **Irregular Heartbeat (Arrhythmia):** Potassium plays a crucial role in regulating heart rhythm, and deficiency can cause abnormal heartbeats, which can be dangerous. [Low blood potassium - UF Health](#)
- **High Blood Pressure:** Studies have shown a link between low potassium intake and increased blood pressure.

### Populations at Risk

- **People with certain medical conditions:** Certain conditions can increase the risk of potassium deficiency, such as kidney disease, vomiting, diarrhea, eating disorders, and those taking certain medications like diuretics.

[1. Hypokalemia - StatPearls - NCBI Bookshelf](#)

- **People with excessive sweating:** Athletes or individuals who sweat excessively may lose significant amounts of potassium, increasing their risk of deficiency. [Low Potassium Level Causes \(Hypokalemia\) - Cleveland Clinic](#)
- **People on restrictive diets:** Diets low in fruits and vegetables can lead to inadequate potassium intake.

# Zinc

## Deficiency Symptoms/Health Problems

- **Impaired Growth and Development:** Zinc is crucial for growth, especially in children and adolescents. Deficiency can lead to stunted growth, delayed sexual development, and impaired cognitive function. Zinc Deficiency
- **Impaired Immune Function:** Zinc plays a vital role in immune system function. Deficiency can lead to increased susceptibility to infections and slower wound healing. The Role of Zinc in Antiviral Immunity
- **Hair Loss:** Zinc deficiency can contribute to hair loss or thinning hair. Zinc and hair loss: Things to know
- **Skin Problems:** Skin lesions, rashes, and delayed wound healing can also be signs of zinc deficiency. Zinc Deficiency
- **Loss of Appetite and Taste:** Zinc is important for taste perception. Deficiency can lead to a decreased appetite and altered sense of taste. Zinc Deficiency: Symptoms, Diagnosis, and More

## Populations at Risk

- **People with gastrointestinal disorders:** Conditions that affect nutrient absorption, like Crohn's disease and celiac disease, can increase the risk of zinc deficiency. Zinc Deficiency
  - **Vegetarians and vegans:** Plant-based diets may contain less bioavailable zinc compared to animal sources, increasing the risk of deficiency if not carefully planned. Zinc: Fact Sheet for Health Professionals
  - **Pregnant and breastfeeding women:** Increased zinc requirements during pregnancy and lactation can put these women at risk if their intake is inadequate. Zinc
  - **Older adults:** Reduced dietary intake and decreased absorption can contribute to zinc deficiency in older adults. Zinc
  - **Vegetarians and vegans:** Plant-based diets may contain less bioavailable zinc compared to animal sources, increasing the risk of deficiency if not carefully planned. [Zinc](#)
  - **Pregnant and breastfeeding women:** Increased zinc requirements during pregnancy and lactation can put these women at risk if their intake is inadequate. [Zinc](#)
  - **Older adults:** Reduced dietary intake and decreased absorption can contribute to zinc deficiency in older adults. [Zinc](#)
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# Iron

## Deficiency Symptoms/Health Problems

- **Iron-Deficiency Anemia:** A common type of anemia characterized by a decrease in red blood cells or hemoglobin, leading to fatigue, weakness, shortness of breath, pale skin, and brittle nails. [\[Iron-Deficiency Anemia - Mayo Clinic\]](#)
- **Fatigue and Weakness:** Even without anemia, low iron levels can cause fatigue, weakness, and decreased energy levels. [\[Iron deficiency - Symptoms and causes - NHS\]](#)
- **Shortness of Breath:** Iron is essential for carrying oxygen throughout the body, and deficiency can lead to shortness of breath, especially during physical activity. [\[Iron deficiency - Symptoms and causes - NHS\]\(https://www.nhs.uk/\)](#)
- **Pale Skin:** Iron deficiency can cause a decrease in blood flow to the skin, resulting in pale skin. [\[Iron deficiency - Symptoms and causes - NHS\]](#)
- **Brittle Nails:** Iron deficiency can weaken nails, making them brittle and prone to breaking. [\[Iron deficiency - Symptoms and causes - NHS\]\(https://www.nhs.uk/\)](#)
- **Other Symptoms:** Iron deficiency can also cause headaches, dizziness, cold hands and feet, and inflammation of the tongue (glossitis). [\[Iron deficiency - Symptoms and causes - NHS\]\(https://www.nhs.uk/\)](#)

## Populations at Risk

- **Women of childbearing age:** Menstrual blood loss increases iron requirements, putting women of reproductive age at higher risk of deficiency. [\[Iron-deficiency anemia\]](#)
- **Pregnant women:** Increased blood volume and the needs of the developing fetus increase iron demands during pregnancy. [\[Iron Needs During Pregnancy\]](#)
- **Infants and young children:** Rapid growth and development increase iron requirements, making infants and young children susceptible to deficiency. [\[Iron deficiency in infants and children\]](#)
- **People with certain medical conditions:** Certain conditions can affect iron absorption or increase iron loss, such as gastrointestinal disorders, heavy menstrual bleeding, and chronic diseases. [\[Iron-Deficiency Anemia\]](#)  
[www.medindia.net](http://www.medindia.net)
- **Frequent blood donors:** Blood donation can deplete iron stores, increasing the risk of deficiency. [\[Blood Donation and Iron\]](#)

## **Important Note**

If you suspect you may have an iron deficiency, it's important to consult with a healthcare professional for proper diagnosis and treatment.

## **Taking Too Much Iron**

While iron is essential, excessive intake can also be harmful. Iron overload can damage organs like the liver, heart, and pancreas. Symptoms of iron overload can include:

- Abdominal pain
- Nausea and vomiting
- Fatigue
- Joint pain
- Skin discoloration (bronzing)
- Liver damage
- Heart problems
- Diabetes

It's crucial to take iron supplements only under the guidance of a healthcare professional and avoid exceeding the recommended daily intake. Iron Overload

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## **CoQ10**

### **Deficiency Symptoms/Health Problems**

- **Fatigue and Muscle Weakness:** CoQ10 plays a vital role in energy production within cells. Deficiency can lead to fatigue, muscle weakness, and exercise intolerance. [CoQ10 Deficiency](#)
- **Increased Oxidative Stress:** CoQ10 acts as an antioxidant, protecting cells from damage caused by free radicals. Deficiency can lead to increased oxidative stress, which may contribute to various health problems.
- **Cardiovascular Problems:** CoQ10 is particularly important for heart health. Deficiency has been associated with an increased risk of heart failure, high blood pressure, and other cardiovascular issues. [Coenzyme Q10](#)
- **Neurological Problems:** CoQ10 is also involved in brain function. Deficiency has been linked to neurological disorders such as migraines, Parkinson's disease, and Alzheimer's disease. [Coenzyme Q10](#)

## **Populations at Risk**

- **Older Adults:** CoQ10 levels naturally decline with age, increasing the risk of deficiency in older individuals.
  - **People with Certain Medical Conditions:** Certain conditions can affect CoQ10 levels or increase the body's need for it, such as heart disease, diabetes, cancer, and mitochondrial disorders.
  - **People Taking Statin Medications:** Statin drugs, commonly used to lower cholesterol, can also reduce CoQ10 levels.
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**Thank You for Your Interest  
In the Companion of the Top 10  
micronutrients from the  
Linus Pauling Institute**