Health by Hope
Functional Nutrition and Lifestyle Strategies

Phosphorus

Why is Phosphorus Important?

Phosphorus is an essential nutrient in the human body. Phosphorus in the form of phosphates is a negatively charged, intracellular, ion that is highly reactive with oxygen forming phosphates that make up peptides and proteins. We consume phosphorus in the form of inorganic phosphate (Pi) or bound to organic molecules. It is absorbed in the small intestine and transported to the rest of your body to be used. Any excess phosphorus is excreted in your urine. About 30% of your body's cellular proteins are phosphorylated. About 85% of the phosphorus in your body is found in the form of hydroxyapatite. The bioavailability of phosphorus depends on many different factors including: the pH of our gut and the presence of other minerals.

*Phosphorylated: this happens when phosphorus binds to something.

*Hydroxyapatite: primary component of your bones and teeth, giving your bones and teeth their strength and hardness.

What Body Functions is Phosphorus Important for?

Bone Growth: Phosphorus is essential for maintaining proper bone density. Phosphorus and calcium bind together to make something called hydroxyapatite. This is what the majority of your bones and teeth are made up of. There is a balance that needs to be kept between calcium and phosphorus to make sure that your bones are healthy. Too much calcium consumption can interfere with your intestinal absorption of phosphorus and too much phosphorus consumption can interfere with your intestinal absorption of calcium.

Protein Structure: While phosphorus isn't part of a protein's primary structure it plays an important role in regulating protein behavior.

Energy: ATP or adenosine triphosphate is the main form of energy found inside of your body and is important for many different functions including muscle contractions, nerve impulse transmission, synthesizing macromolecules, transport of macromolecules, active transport of molecules against their gradients, chemical synthesis, and intracellular signaling. Without

phosphorus your body wouldn't be able to make ATP and many body functions would be affected.

Nucleic Acid Production: DNA and RNA are crucial molecules to human life. You wouldn't be here if you didn't have DNA or RNA. Phosphate forms the backbone of both molecules. If you are not consuming enough phosphate your DNA synthesis will be inhibited. This means if your body is trying to heal or produce more cells it cannot.

Different Types of Phosphorus:

Phytate: This is main phosphorus storage system in cereal grains, nut, seed oils, and legumes. 80% of total phosphorus. It is generally considered to have a low bioavailability due to its inability to be absorbed. Consuming too much of this can decrease your body's ability to absorb other essential minerals. However, this form of phosphorus has been found to inhibit/reduce the bioavailability of fats and sugars and a plant-based diet, high in phytate, is recommended in people with chronic kidney disease.

Sodium Phosphate: This type of phosphorus is a phosphate salt and is used in processed foods to help preserve food.

Phosphatidylcholine: This type of phosphate is a phospholipid and is a very important structural component in eukaryotic cell membranes.

Phosphatidylserine: This type of phosphate is a phospholipid and is a very important structural components in your brain cells membrane's.

Food Sources Phosphorus is in:

Animal Sources	mg/Serving
Plain Yogurt (6 ounces)	245
Cow's Milk (1 cup)	220
Salmon (3 ounces)	214
Scallops (3 ounces)	201
Mozzarella Cheese (1.5 ounces)	197
Chicken Breast (3 ounces)	182
90% Lean Beef Patty (3 ounces)	172
Hard Boiled Egg	86
Lentils (½ cup)	178
Plant Sources	**mg/Serving**
Cashews (1 ounce)	139
Russet Potato	123
Kidney Beans (½ cup)	115
Brown Rice (½ cup)	102
Green Peas (½ cup)	94
Oatmeal (½ cup)	90
Corn Tortilla	82
Whole Wheat Bread (1 slice)	60
Sesame Seeds (1 Tbsp)	57
Pita Bread	50
Asparagus (½ cup)	49
Tomato	22
Apple	20
Cauliflower (½ cup)	20
Clementine	16

Signs and Causes of Phosphorus Deficiency:

Phosphorus deficiency is very rare in the United States and isn't usually caused by low phosphorus intake. It is usually caused by certain health conditions. For example, diabetic ketoacidosis (DKA), hyperparathyroidism, kidney tubule defects, severe burns, and sepsis. **Other causes can be Vitamin D deficiency**. This is because vitamin D is essential for stimulating bone growth.

Musculoskeletal Signs: Muscle pain, bone pain, muscle weakness, numbness, and weak reflexes are all signs of hypophosphatemia. This is because you don't have enough phosphorus for your nerves to function properly. Your bones can hurt because their structure and density can be affected by low phosphorus levels.

Neurologic Signs: Confusion, irritability, and seizures can be caused by hypophosphatemia. This is because your brain needs phosphorus for proper nerve signaling.

In children, low phosphorus levels can cause rickets.

Hypophosphatemia: Low blood phosphorus levels

Hyperparathyroidism: Overactive parathyroid glands.

Signs and Causes of Phosphorus Toxicity:

Phosphorus toxicity is on the rise in the United States. This is due to the increase in processed food consumption. Majority of processed foods contain phosphate additives for preserving, adding flavor, or creating a certain texture. These types of phosphates are very easily absorbed by our bodies creating an increase in your phosphorus levels. Phosphorus is a lesser-known nutrient, so there is less labeling on foods and beverages about their phosphorus content leading people to continue to consume too much phosphorus. Causes include increased processed food and beverage intake, chronic kidney disease, and hypertension.

Muscular Signs: Muscle cramps can be caused by hyperphosphatemia. This is because too much phosphorus can cause your muscles to not be able to relax properly after contracting leading to muscle cramps.

Cardiovascular Signs: Cardiac arrythmias can be caused by hyperphosphatemia. This is because it can affect the hearts' ability to contract and relax properly.

Neurologic Signs: Memory problems, irritability, and seizures can be caused by hyperphosphatemia. This is because too much phosphorus interferes with your brains ability to conduct neuron signals.

Other Signs: Dry, brittle nails, dry skin, and coarser hair than normal can be caused by hyperphosphatemia. This is because hyperphosphatemia can cause hypocalcemia which can lead to soft tissue calcification leading to increased dryness.

Hyperphosphatemia: high blood phosphorus levels

Supplementation of Phosphorus:

Supplementation of phosphorus should only be done if you are deficient in phosphorus. Supplementation if you are deficient can reduce your risk of osteoporosis and other health conditions.

***It is important to know that dietary intake of phosphorus should be your main source of phosphorus, and any phosphorus supplements should supplement the phosphorus you are already ingesting.**

Daily Recommended Dose of Phosphorus:

Age	Amount
Birth to 6 months	100 mg
7-12 months	275 mg
1-3 years	460 mg
4-8 years	500 mg
9-13 years	1,250 mg
14-18 years	1,250 mg
19 + years	700 mg

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