Estimation of Na+, K+, P+ and Ca++

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Lab -2- Metabolic Disorders

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Sodium: is the major cation of extracellular fluid. It plays a central role in the maintenance of water and the osmotic pressure in the various fluid compartments. The main source of body sodium is sodium chloride contained in ingested foods. About 50% of it is in bones, 40% in extracellular fluid and 10% in soft tissues.

Hyponatremia (low serum sodium level): It is found in a variety of conditions including the following: severe polyuria, diarrhea, and renal disease.

Hypernatremia (increased serum sodium level): It is found in the following conditions: severe dehydration, excess treatment with sodium salts, excessive aldosterone secretion.

Normal levels: Serum/Plasma: 135-145 mmol/ L.

Potassium is the principle cation of the intracellular fluid. It is also an important constituent of the extracellular fluid due to its influence on muscle activity. 98% of potassium in the body present within the cells and only 2% are present in the plasma.

High potassium levels (hyperkalemia) related with:

* Renal failure.
* Dehydration shock.
* Adrenal insufficiency (Aldosterone).

Low potassium levels (hypokalemia) related with:

* Malnutrition.
* Negative nitrogen balance.
* Hyperactivity of the adrenal cortex.

Functions of Potassium:

-influencing acid-base balance

-osmotic pressure, including water retention.

-Help nerves to function

-Maintaining heartbeat

-Muscle contractions.

Normal Values: Adults 3.5 to 5.1 mmol/L or (13.7-19.9 mg/dL)

Phosphorus: this element is called phosphorus because of its ability to glow in the dark.

A-White Phosphorous:

yellow phosphorus or simply tetraphosphorus (P4) exists as molecules made up of four atoms in a tetrahedral structure .White phosphorus is a translucent waxy solid that quickly becomes yellow when exposed to light. For this reason it is also called yellow phosphorus

B- Red Phosphorous : may be formed by heating white phosphorus to 300°C in the absence of air or by exposing white phosphorus to sunlight. Red phosphorus does not ignite in air at temperatures below 240°C, whereas pieces of white phosphorus ignite at about 30°C

Note: Heating red phosphorus in the presence of moisture creates phosphine gas, which is both highly flammable and toxic.

Calcium (Ca2+): Play roles in human physiology. In bone, it combines with phosphorus giving strength to the bone structure. It is important in blood coagulation, muscle contraction and membrane permeability. 99 % from calcium is found in bone and teeth, 45% free ionized calcium in blood and 45% bound with albumin, 10% complexed with anions e.g. citrate.

Functions:

-To build and maintain strong bones.

-To help muscles move.

-To help the nerves to carry messages between the brain and the rest of a body.

-To help the blood vessels move blood throughout the body.

-To help release hormones that affect many functions in the body.

Hypercalcaemia: is an elevated calcium level in the blood.

Causes:

A-Eating large amounts of milk products.

B-taking too many calcium-containing medications (such as vitamin supplements) can cause high blood calcium levels.

C-Hyperparathyroidism.

D-Hyperthyroidism.

Hypocalcaemia: Is the presence of low serum calcium levels in the blood, usually taken as less than 8.5 mg/dl .

Causes : hypoparathyroidism , Acute and chronic renal failure and Defective Vitamin D metabolism

Calcium toxicity:

Excess calcium supplementation has been associated with Formation of "stones" in the body, especially the Gall Bladder and the Kidneys.

Plasma calcium is present in two forms:

Total calcium: 45% of total calcium in the blood is bound to Albumin and therefore total calcium levels varies according to albumin concentration.

Ionized calcium: is the physiologically active form of calcium. which measures the calcium that is unattached or "free" from these proteins.

Normal levels

-Plasma: Adults: 8.5 – 10.5 mg/dl (varies according to albumin concentration).

-Newborn: 7.5 - 10.5

-Serum ionized calcium: 4.5 - 6 mg/dl

CALCULATIONS:

$\frac{A\ sample}{A\ standard}$ x C standard= mg/dL total calcium

Thank you for listening