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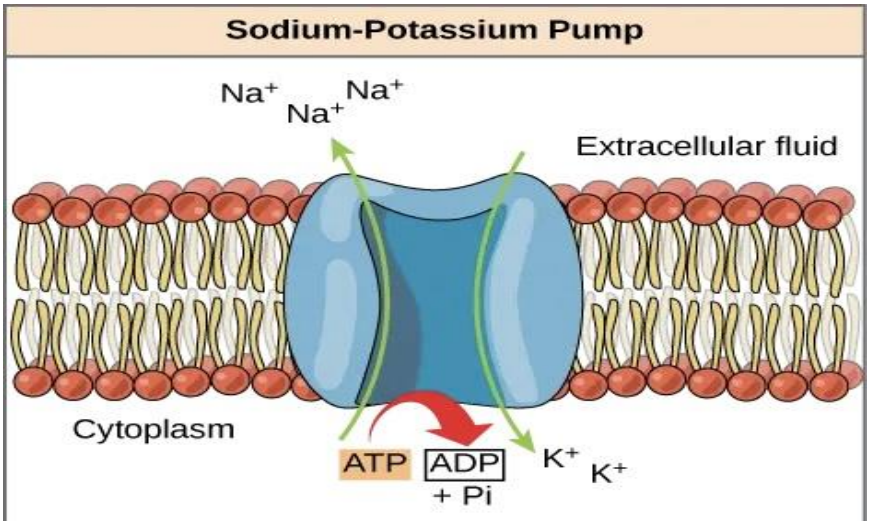
Lecture title: **Animal nutrition: Potassium, Sodium, and Chlorine**

Lecturer Affiliation: *Professor, Dr.* ***Muntaha Ghazi Hasan***
Department of Public Health,College of Veterinary Medicine, University of Mosul, Mosul, Iraq
https://orcid.org/ 0000-0001-7250-0117

Summary:

Potassium, sodium, and chlorine

Potassium the third most abundant mineral in the body at about 3.0 g/ kg live weight, it is playing a very important part, along with sodium, chlorine, and bicarbonate ions, in osmotic regulation of the body fluids and in the acid–base balance in the animal. Potassium contributes to about 50% of intracellular osmolarity. potassium functions principally as the cation of cells. It is playing an important part in nerve and muscle excitability; Potassium is also involved in carbohydrate metabolism. Many enzymes have specific or facilitative requirements for potassium and the element influences many intracellular reactions involving phosphate, with effects on enzyme activities and muscle contraction. Potassium is present in the enterocyte as a free cation and is transported out of the cell by the basolateral K^+ channels, Potassium is absorbed into the portal vein and carried in the plasma as a free cation for uptake by extraintestinal cells through K^+ channels and K–Cl cotransporters. Also, Potassium is required to maintain a low gastric-luminal pH and facilitate protein digestion in animals. Potassium is involved in the sodium pump activity and in the functioning of the nerves and muscle cells.



Sources of potassium

Potassium concentrations in forages are highly variable. that of grass, being frequently above 25 g/kg dry matter.

Potassium deficiency

Potassium deficiency occurs when (plasma K concentration <3.5 mM), which is known as hypokalemia, results from inadequate dietary intake, gastrointestinal loss (e.g., through vomiting and diarrhea) potassium deficiency is rare in farm animals kept under natural conditions. potassium deficiencies may arise in grazing animals, especially at the end of the long dry season, when potassium levels in the mature herbage are low. chicks given diets low in potassium lead to retarded growth, weakness and tetany, paralysis, low blood pressure, frequent urination, and thirst. Finally, hypokalemia can also cause cardiac rhythm abnormalities, and even death in animals.

Excess of potassium

Excess concentration of K^+ in the plasma greater than 5.5 mM is defined as hyperkalemia, which can result from excessive intake, excessive release from cells due to hemolysis and tissue injury, syndromes of hyperkalemia include reduced feed intake and impaired growth; fatigue and muscle Weakness, high intake of potassium may interfere with the absorption and metabolism of magnesium in the animal. This critical role of potassium is illustrated by hyperkalemic periodic paralysis (HYPP), which is a genetic disease associated with an increase in serum potassium concentration in horses.

Sodium

It is the fourth most abundant mineral in the animal body, in domestic animals, the concentrations of sodium are about 14 mM in the intracellular fluid. Sodium is absorbed into the portal vein and carried in the plasma for uptake by extraintestinal cells through sodium channels or transporters. Intestinal absorption of sodium is coupled with water absorption and, therefore, plays an important role in preventing diarrhea. Most of the sodium of the animal body is present in the soft tissues and body fluids. sodium is concerned with the acid–base balance and osmotic regulation of the body fluids it is the chief cation of blood plasma and body extracellular fluids. Sodium also plays a role in the transmission of nerve impulses. It is important in the absorption of sugars and amino acids from the digestive tract. Much of the sodium is ingested in the form of sodium chloride (common salt).

Sources of sodium

Most foods of vegetable origin have comparatively low sodium contents, animal products, especially foods of marine origin, are richer sources. Na is usually added as 0.20%–0.35% NaCl to corn- and soybean meal-based diets for poultry. The commonest mineral supplement given to farm animals is common salt. For grazing animals, NaCl is generally supplemented to their diets in free-choice mineral salts.

Deficiency symptoms

A deficiency of sodium in the diet leads to:

- lowering of the osmotic pressure, which results in dehydration of the body.
- poor growth
- reduced use of digested proteins and energy.
- In hens, egg production and growth are adversely affected.
- reproductive disturbances.

Excess of sodium

A major concern over sodium nutrition in animals is the role of high sodium intake in the development of hypertension due to increased water volume in blood vessels.

Chlorine

Chloride is the principal anion in the extracellular fluid. Chloride is absorbed into the portal vein and carried in the plasma as a free cation for uptake by extraintestinal cells through chloride channels, primarily calcium activated Cl channels. Chlorine is associated with sodium and potassium in acid–base relationships and osmotic regulation. also plays an important part in the gastric secretion, where it occurs as hydrochloric acid as well as chloride salts. Chlorine is excreted from the body in the urine and is also lost from the body, along with sodium and potassium, in perspiration.

Chlorine sources

The main source of chlorine for most animals is common salt.

Deficiency symptoms

A dietary deficiency of chlorine may lead to an abnormal increase of the alkali reserve of the blood (alkalosis) caused by an excess of bicarbonate, retard growth. Hens fed on diet deficient in salts

exhibit feather picking and cannibalism. In case of common salt imbalance, Appetite declined, with next loss in weight and lowered milk production. The addition of salt to the diet produced an immediate cure.

Excess of chlorine

In animals, syndromes of hyperchloremia include high concentrations of sodium in the plasma, kidney failure. nausea, vomiting, and diarrhea; reduced feed intake and impaired growth; sweating, dehydration, and high body temperature; fatigue and muscular weakness; metabolic acidosis, and thirst; brain injury; and impaired oxygen transport by red blood cells. Hens can tolerate larger amounts of salt if plenty of water is available. When the concentration of salt in the diet of hens exceeds 40 g/kg DM and the supply of drinking water is limited, then death may occur. Chicks cannot tolerate salt as well as adults, and 20 g/kg DM in the diet should be regarded as the absolute maximum.