



## Minerals Matter: A Poultry Perspective



**Pramod Kumar Soni<sup>1\*</sup>, Deepesh Bharat Mishra<sup>2</sup>, Gaurav Kumar<sup>1</sup>, Dinesh Kumar<sup>3</sup>  
Manmohan Singh Rajput<sup>4</sup>, Divyanshu Singh Tomar<sup>1</sup>**

<sup>1</sup>Assistant Professor, College of Veterinary & Animal Sciences, Datia Campus, RLBCAU, Jhansi, Uttar Pradesh

<sup>2</sup>Subject matter Specialist, DRI, KVK, Chitrakoot, Uttar Pradesh

<sup>3</sup>Assistant Professor cum Junior Scientist, College of Veterinary Science & Animal Husbandry, BAU, Kanke, Ranchi, Jharkhand

<sup>4</sup>Assistant Professor, ND College Shikohabad, DBARU, Agra, Uttar Pradesh

### INTRODUCTION

Poultry farming has become a key contributor to rural livelihoods and nutrition security. While poultry feed is often formulated with protein and energy in mind, the importance of minerals in bird health and productivity is sometimes overlooked. Just like humans need vitamins and minerals to stay healthy, chickens also need a balanced mineral intake for strong bones, egg production, immunity, and overall well-being.

Why are minerals important?

Minerals are inorganic elements found in small quantities in the body but play big roles. Minerals are broadly classified into macro minerals and trace minerals, depending on the quantity required by the bird. Macrominerals such as calcium, phosphorus, sodium, potassium, magnesium, and chloride are required in larger amounts (more than 100 mg/kg of body weight), while trace minerals such as iron, copper, zinc, selenium, iodine, and manganese are needed in minute quantities but are equally important. These minerals are vital for bone development, eggshell formation, enzyme function, blood health, and hormone production.



#### Article History

**Received :** 03. 08.2026

**Revised :** 10. 08.2026

**Accepted :** 17. 08.2026



#### Corresponding Author

**Pramod Kumar Soni<sup>1\*</sup>**

**E-mail ID:**

pramod.soni26@gmail.com



#### Open Access

This article is published under the terms of the [Creative Commons Attribution License 4.0](https://creativecommons.org/licenses/by/4.0/).

### Key mineral deficiencies and their impact

**Calcium (Ca) and phosphorus (P):** Starting with calcium and phosphorus, these two minerals are vital for the formation of bones and eggshells. In young growing birds, a deficiency in either calcium or phosphorus leads to poor skeletal development and rickets, despite the presence of adequate vitamin D. In laying hens, calcium deficiency results in fragile eggshells and a condition known as "cage layer fatigue," where calcium is excessively withdrawn from the bones, weakening the skeletal structure and causing osteoporosis. Layers need about 4 grams of calcium daily to maintain eggshell quality and bone health.

**Manganese (Mn):** Plays a crucial role in bone formation and enzyme activation. Its deficiency in young chickens and turkeys causes leg deformities such as perosis, characterized by twisted and malformed leg bones, slippage of tendons, and impaired hatchability due to defective eggshell formation.

**Iron (Fe):** is essential for the synthesis of hemoglobin. Deficiency causes anemia, pale combs, and feather discoloration in colored-feathered birds.

**Copper (Cu):** Deficiency leads to anemia and fragile bones in chicks, often accompanied by ataxia and spastic paralysis. Copper is important for cartilage formation and interacts with certain dietary components such as fumigants and phytates that may interfere with its absorption.

**Iodine (I):** is critical to produce thyroid hormones. In its absence, birds develop goiter due to thyroid gland enlargement. Iodine deficiency also leads to poor feather development, reduced hatchability, and delayed yolk sac absorption in chicks. It is important to supplement at least 2–3 mg of iodine per kg of feed, especially in diets containing goitrogens such as rapeseed meal.

**Magnesium (Mg):** Though rare, magnesium deficiency can occur in laying hens, leading to a sharp decline in egg production, smaller eggs, and hypomagnesemia. Magnesium, in synergy with calcium, is involved in eggshell formation and muscle function.

**Sodium (Na), potassium (K) and chloride (Cl):** The electrolytes sodium, potassium and chloride are necessary to maintain acid-base and water balance in the bird's body. Sodium deficiency leads to low osmotic pressure, reduced blood pressure, poor egg production, and even cannibalism in layers. Hypokalemia (low potassium) results in overall muscle weakness, poor gut motility, and respiratory failure. Chloride deficiency causes nervous symptoms such as ataxia. Importantly, the electrolyte balance, defined by the formula  $Na + K - Cl$  (measured in mEq/kg), should be maintained at 250–300 mEq/kg of diet for optimal physiological functioning. Electrolyte imbalances can lead to skeletal issues such as tibial dyschondroplasia in broilers and respiratory alkalosis in layers. The use of additives like ammonium chloride or phytase enzymes can affect electrolyte status and should be managed carefully.

**Selenium (Se):** Deficiency in chicks causes a condition known as exudative diathesis, where fluid accumulates under the skin, especially on the inner thighs and wings. Although rare in layers, selenium deficiency affects egg production, hatchability, and feed conversion. Selenium and vitamin E have a synergistic role as antioxidants, and sometimes vitamin E supplementation can alleviate selenium-deficiency symptoms. Selenium is commonly supplemented in the form of sodium selenite or organic selenium, with a safe upper limit of around 0.3 ppm in poultry diets.

**Zinc (Zn):** is another vital trace mineral necessary for growth, feathering, immune function, and embryo development. Zinc deficiency results in stunted growth, thickened

and short bones, poor feathering, and high chick mortality. In breeders, zinc deficiency leads to severe skeletal deformities in embryos, such as curved spines, missing toes, and in extreme cases, absence of lower limbs. The presence of phytic acid in grains can reduce zinc absorption, but phytase enzyme supplementation helps improve its availability.

**Cobalt (Co):** For instance, plays an indirect but important role in poultry nutrition. While poultry cannot synthesize vitamin B<sub>12</sub> from cobalt like ruminant can, cobalt still supports overall metabolism. A deficiency of cobalt may result in poor hatchability, slow growth, and increased mortality. However, poultry diets typically rely on direct vitamin B<sub>12</sub> supplementation rather than elemental cobalt.

**Fluorine (F):** is another mineral that, in trace amounts, contributes to bone strength and dental development. However, its role in poultry is not well-defined, and excessive fluorine can be toxic, leading to poor bone development, kidney problems, and growth retardation. Monitoring its levels, especially when using rock phosphate as a feed additive, is essential.

**Silicon (Si):** although not traditionally listed in mineral premixes, supports bone matrix development and structural strength. Research shows that silicon deficiency in chicks may impair skeletal growth, although this deficiency is rare due to its abundance in plant-based feeds.

**Chromium (Cr):** is gaining attention in poultry nutrition, particularly for its role in regulating carbohydrate and fat metabolism and improving stress tolerance in broilers. Though chromium deficiency is not clearly defined, supplementation especially in organic forms like chromium picolinate has been shown to improve growth performance and immunity, especially under heat or transport stress.

**Molybdenum (Mo):** Serves as a cofactor for several enzymes involved in nitrogen and sulfur metabolism. While its deficiency is rare in poultry, high levels of molybdenum can interfere with copper absorption, leading to signs like copper deficiency such as anemia and poor bone formation.

**Boron (B):** is another mineral of interest though not officially classified as essential, boron is increasingly being recognized for its role in bone development, eggshell quality and mineral metabolism. Deficiencies in boron may lead to reduced bone strength and poor reproductive performance. While supplementation is not yet routine it has shown promise in improving skeletal health and egg production.

**Vanadium (V):** is not required in poultry diets, but it is noteworthy due to its toxic potential. It is often found as a contaminant in some phosphate sources. Even at low levels, vanadium can cause brown yolk discoloration, poor growth, and reduced feed intake in birds. Hence, care must be taken when choosing phosphate sources, especially rock phosphate.

**Nickel (Ni):** is another trace mineral occasionally present in poultry diets. It plays a role in iron metabolism and enzyme activation, though its deficiency is not well documented. Like vanadium, excess nickel is toxic and hence it is not commonly added deliberately to poultry diets.

**Sulfur (S):** is an important component of sulfur-containing amino acids like methionine and cysteine. These amino acids are crucial for feather development, enzyme function, and protein synthesis. A lack of sulfur or methionine can lead to poor feathering, dull appearance, and slow growth. Although sulfur is not usually supplemented directly, it is included through methionine in poultry feed formulations.

**Table 1: Macro minerals in poultry Functions and Deficiency Symptoms in Poultry**

| Mineral               | Main Functions                              | Deficiency Symptoms                                            |
|-----------------------|---------------------------------------------|----------------------------------------------------------------|
| <b>Calcium (Ca)</b>   | Bone formation, eggshell production         | Weak bones, broken eggshells, osteoporosis, cage layer fatigue |
| <b>Phosphorus (P)</b> | Bone health, energy metabolism              | Rickets, poor growth, poor shell quality                       |
| <b>Sodium (Na)</b>    | Water balance, nerve function               | Poor egg production, cannibalism, low blood pressure           |
| <b>Potassium (K)</b>  | Muscle function, acid-base balance          | Weakness, poor digestion, respiratory issues                   |
| <b>Chloride (Cl)</b>  | Maintains acid-base balance                 | Ataxia (lack of coordination), slow growth                     |
| <b>Magnesium (Mg)</b> | Enzyme activity, muscle movement            | Small eggs, drop in egg production                             |
| <b>Sulfur (S)</b>     | Part of methionine and cysteine amino acids | Poor feathering, weak growth                                   |

**Table 2: Trace (Micro) Minerals in Poultry: Functions and Deficiency Symptoms**

| Mineral                | Main Functions                                                                  | Deficiency Symptoms                                                                |
|------------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| <b>Zinc (Zn)</b>       | Growth, feathering, skin health, immunity, bone development                     | Poor feathering, short bones, stunted growth, curved embryos, high chick mortality |
| <b>Iron (Fe)</b>       | Hemoglobin production, oxygen transport                                         | Anemia, pale combs, dull feathers                                                  |
| <b>Copper (Cu)</b>     | Enzyme activity, iron metabolism, bone and nerve development                    | Anemia, bone fragility, twisted legs, poor coordination (ataxia)                   |
| <b>Manganese (Mn)</b>  | Bone formation, eggshell quality, enzyme activation                             | Leg deformities (perosis), poor hatchability, slipped tendons                      |
| <b>Iodine (I)</b>      | Thyroid hormone production, growth, feather and skin development                | Goiter (thyroid swelling), poor growth, low hatchability, feather loss             |
| <b>Selenium (Se)</b>   | Antioxidant defense (with Vitamin E), immune function, reproductive performance | Exudative diathesis (swelling under skin), low hatchability, poor egg production   |
| <b>Cobalt (Co)</b>     | Vitamin B12 synthesis in microbes (limited role in poultry), metabolism support | Slow growth, poor hatchability (rarely needed directly in poultry diets)           |
| <b>Chromium (Cr)</b>   | Stress tolerance, carbohydrates and fat metabolism                              | Not well-defined; improves immunity under heat/transport stress when supplemented  |
| <b>Molybdenum (Mo)</b> | Enzyme cofactor in nitrogen and sulfur metabolism                               | Rare; excess interferes with copper absorption, leading to anemia                  |
| <b>Nickel (Ni)</b>     | Enzyme activation, iron utilization                                             | Deficiency signs unclear; high levels are toxic                                    |
| <b>Boron (B)</b>       | Bone metabolism, eggshell strength, mineral absorption                          | Weak bones, poor reproduction, low egg quality (not routinely supplemented)        |
| <b>Fluorine (F)</b>    | Bone and dental development (in very small amounts)                             | Toxicity: bone damage, kidney problems, stunted growth                             |
| <b>Vanadium (V)</b>    | No known essential role; commonly a contaminant in phosphate sources            | Toxic: brown yolk, feed refusal, poor growth                                       |
| <b>Silicon (Si)</b>    | Bone matrix and cartilage development                                           | Poor skeletal growth in chicks (rare)                                              |

## CONCLUSION

Mineral deficiencies often referred to as “hidden hunger,” can have visible and devastating effects on poultry health and productivity. Farmers should ensure that their birds receive a balanced diet with proper levels of both macro and trace minerals. Regular use

of mineral premixes, clean water, and high-quality feed ingredients, along with awareness of dietary interactions and anti-nutritional factors, is essential. Monitoring the signs of mineral imbalances and taking timely corrective actions can help achieve better growth, stronger immunity, improved egg quality and higher farm profitability.

